

## **5. FURTHER ANALYSES OF ROUND TWO POLLUTANTS**

### **5.1 INTRODUCTION**

Chapter 4 presented the risk assessments used in the Comprehensive Hazard Identification to evaluate the list of candidate pollutants for the Part 503 Round Two regulation. In that Chapter, results are presented only for those pollutant-exposure pathway combinations for which all pollutant-specific data are available. Examples of pollutant-specific data are plant-uptake slopes for different crops; animal uptake slopes for livestock, poultry, etc.; distribution coefficients ( $K_d$ s); and human and ecological toxicity values. In this chapter, the candidate pollutants that warrant further consideration for the final list are presented. For each pollutant, the critical pathways, defined as exposure pathways for which the carcinogenic risk is  $1 \times 10^{-4}$  or higher, the ratio of exposure to the Risk Reference Dose (RfD) is one or greater, or the ecological risk quotient (RQ) is one or greater, are summarized.

### **5.2 POLLUTANTS THAT WARRANT FURTHER CONSIDERATION**

Based on the results of the risk assessments of the Comprehensive Hazard Identification, 12 pollutant candidates have critical pathways for land application and five pollutant candidates have critical pathways for surface disposal. These pollutant candidates and their critical pathways are summarized below in Exhibits 5-1 and 5-2, respectively. None of the inorganic pollutants evaluated had a critical pathway for incineration.

**EXHIBIT 5-1**  
**Pollutants with Critical Land Application Pathways**

Pollutant	Critical Agricultural Pathways	Critical Non-Agricultural Pathways
Aluminum	6	6 (for., rec., pub.)
Antimony	7, 14	7 (for., rec.); 10 (for., pub.); 14 (for., rec., pub.)
Barium	7, 10, 14	7 (for., rec.); 10 (for., rec., pub.); 14 (for., rec., pub.)
Beryllium	14	14 (for., rec., pub.)
Boron		6 (for., pub.)
Dioxins and Dibenzofurans	2, 3, 10, 12, 13, 15	3 (for., rec., pub.); 10 (for., rec., pub.); 12 (for., rec., pub.); 13 (for., rec., pub.); 15 (for., rec., pub.)
Fluoride	6, 10	6 (for., rec., pub.); 10 (for., rec., pub.)
Manganese	3, 6, 7, 14	3 (for., rec., pub.); 4 (for., rec.); 6 (for., rec., pub.); 7 (for., rec.); 10 (for., pub.); 14 (for., rec., pub.)
PCBs-coplanar	3, 4, 5, 6, 15	3 (for., rec., pub.); 4 (for., rec.); 5 (for., rec.); 6 (for., rec., pub.); 13 (for., rec.); 15 (for., rec., pub.)
Thallium	3	3 (for., rec., pub.)
Tin	7	7 (for., rec.)
Titanium	6	6 (rec.)

Notes:

Pathway 2 = residential home gardener  
Pathway 3 = child ingesting sewage sludge  
Pathway 4 = human ingesting animal products  
Pathway 6 = livestock ingesting forage/pasture  
Pathway 7 = livestock ingesting sewage sludge  
Pathway 10 = soil organism predators ingesting soil organisms  
Pathway 12 = humans ingesting surface water and fish  
Pathway 13 = humans inhaling volatilized pollutants  
Pathway 14 = humans ingesting groundwater  
Pathway 15 = breastfeeding infant  
for. = forest land  
rec. = reclamation site  
pub. = public contact site

**EXHIBIT 5-2**  
**Pollutants with Critical Surface Disposal Pathways**

<b>Pollutant</b>	<b>Surface Impoundments</b>
Antimony	Groundwater
Barium	Groundwater
Beryllium	Groundwater
Dioxins and Dibenzofurans	Air
Manganese	Groundwater

From Exhibits 5-1 and 5-2, it is evident that the organic candidate pollutants dioxins and dibenzofurans as well as coplanar PCBs have more critical pathways than the inorganic candidate pollutants, except for manganese, which has the same number of critical pathways. These two organic pollutant candidates are recommended to be included on the list of pollutants for the Round Two regulation. The Agency has decided not to recommend including any of the inorganic pollutants on the list for the Round Two regulation, however. The justifications for that decision are presented in Appendix D on a pollutant by pollutant basis.

## **6. LIST OF POLLUTANTS FOR THE ROUND TWO REGULATION SUBMITTED TO THE COURT**

In May, 1993, the Agency submitted a list of 31 pollutant candidates for the Part 503 Round Two regulation to the District Court in Oregon. A copy of the court notice is presented in Appendix D1. On November 30, 1995, EPA submitted the final list of pollutants for the Part 503 Round Two regulation to the court. A copy of that court notice is presented in Appendix D2.

After considering the results of the Comprehensive Hazard Identification, the analysis of pollutants that warranted further consideration, and information received from others, EPA concluded that two pollutants should be on the list for each use or disposal practice. They are: dioxins/dibenzofurans (all monochloro to octachloro congeners) and polychlorinated biphenyls (coplanar). The court notice indicates that EPA may, in the exercise of its discretion, determine to add or delete other pollutants to or from this list at the time the Round Two regulation is proposed.

In addition to the list of pollutants submitted to the court, EPA may change a limit for any of the pollutants in the Round One regulation during development of the Round Two regulation. For this reason, the Round One pollutants also are considered pollutants for the Round Two regulation.

Including the pollutants from Round One regulation, the list of pollutants for the Part 503 Round Two regulation by use or disposal practice is:

### **Land application**

arsenic, cadmium, copper, lead, mercury, molybdenum, nickel, selenium, zinc, dioxins/dibenzofurans, and coplanar polychlorinated biphenyls

### **Surface disposal**

arsenic, chromium, nickel, dioxins/dibenzofurans, and coplanar polychlorinated biphenyls

### **Sewage sludge incineration**

arsenic, beryllium, cadmium, chromium, lead, mercury, nickel, dioxins/dibenzofurans, and coplanar polychlorinated biphenyls

Dioxins/dibenzofurans and coplanar polychlorinated biphenyls were included on the list of pollutants for sewage sludge incineration even though they were regulated under the Total Hydrocarbons operational standard in Round One. EPA currently is conducting a reassessment of dioxins/dibenzofurans. Because the results of this assessment are unknown, dioxins/dibenzofurans were included on the Round Two list of pollutants for all use or disposal practices. At the completion of the dioxin reassessment, EPA may decide not to regulate

dioxins/dibenzofurans for a particular use or disposal practice or may decide to regulate dioxins/dibenzofurans on an accelerated schedule.

## 7. REFERENCES

- Abt Associates Inc. 1989. Characterization of Surface Disposal for Wastewater Sludge. Memorandum to Alan Rubin, U.S. EPA Office of Water Regulations and Standards. March 27.
- Agbenin, J.O., G. Lombin, and J.J. Owunubi. 1991. Direct and Interactive Effect of Boron and Nitrogen on Selected Agronomic Parameters and Nutrient Uptake by Cowpea (*Vigna unguicula*) Under Glasshouse Conditions. *Trop. Agric. (Trinidad)*. 68(4):356-362.
- Agency for Toxic Substances and Disease Registry. 1989. Toxicological Profile for Phenol. Prepared by Syracuse Research Corporation under subcontract to Clement International Corporation under contract no. 205-88-0608. U.S. Public Health Service. ATSDR/TP-89/20.
- Agency for Toxic Substances and Disease Registry. 1990. Toxicological Profile for Silver. Prepared by Clement International Corporation under contract no. 205-88-0608. U.S. Public Health Service. ATSDR/TP-90/24.
- Agency for Toxic Substances and Disease Registry. 1992a. Toxicological Profile for Aluminum and Compounds. Prepared by Clement International Corporation under contract no. 205-88-0608. U.S. Public Health Service. ATSDR/TP-91/01.
- Agency for Toxic Substances and Disease Registry. 1992b. Toxicological Profile for Antimony and Compounds. Prepared by Clement International Corporation under contract no. 205-88-0608. U.S. Public Health Service. ATSDR/TP-91/02.
- Agency for Toxic Substances and Disease Registry. 1992c. Toxicological Profile for Barium and Compounds. Prepared by Clement International Corporation under contract no. 205-88-0608. U.S. Public Health Service. ATSDR/TP-91/03.
- Agency for Toxic Substances and Disease Registry. 1992d. Toxicological Profile for Boron and Compounds. Prepared by Life Systems under subcontract to Clement International Corporation under contract no. 205-88-0608. U.S. Public Health Service. ATSDR/TP-91/05.
- Agency for Toxic Substances and Disease Registry. 1992e. Toxicological Profile for 2-Butanone. Prepared by Syracuse Research Corporation under subcontract to Clement International Corporation under contract no. 205-88-0608. U.S. Public Health Service. ATSDR/TP-91/08.
- Agency for Toxic Substances and Disease Registry. 1992f. Toxicological Profile for Carbon Disulfide. Prepared by Clement International Corporation under contract no. 205-88-0608. U.S. Public Health Service. ATSDR/TP-91/09.

Agency for Toxic Substances and Disease Registry. 1992g. Toxicological Profile for Cresols. Prepared by Syracuse Research Corporation under subcontract to Clement International Corporation under contract no. 205-88-0608. U.S. Public Health Service. ATSDR/TP-91/11.

Agency for Toxic Substances and Disease Registry. 1992h. Toxicological Profile for Manganese and Compounds. Prepared by Life Systems under subcontract to Clement International Corporation under contract no. 205-88-0608. U.S. Public Health Service. ATSDR/TP-91/19.

Agency for Toxic Substances and Disease Registry. 1992i. Toxicological Profile for Thallium. Prepared by Life Systems under subcontract to Clement International Corporation under contract no. 205-88-0608. U.S. Public Health Service. ATSDR/TP-91/26.

Agency for Toxic Substances and Disease Registry. 1992j. Toxicological Profile for Tin and Compounds. Prepared by Life Systems under subcontract to Clement International Corporation under contract no. 205-88-0608. U.S. Public Health Service. ATSDR/TP-91/27.

Agency for Toxic Substances and Disease Registry. 1992k. Draft: Toxicological Profile for Toluene. Prepared by Life Systems under subcontract to Clement International Corporation under contract no. 205-88-0608. U.S. Public Health Service.

Agency for Toxic Substances and Disease Registry. 1992l. Toxicological Profile for Vanadium and Compounds. Prepared by Clement International Corporation under contract no. 205-88-0608. U.S. Public Health Service. ATSDR/TP-91/29.

Agency for Toxic Substances and Disease Registry. 1993a. Draft: Toxicological Profile for Asbestos (Update). Prepared by Life Systems under subcontract to Clement International Corporation under contract no. 205-88-0608. U.S. Public Health Service. ATSDR/TP-91/02.

Agency for Toxic Substances and Disease Registry. 1993b. Toxicological Profile for Di(2-Ethylhexyl)Phthalate (DEHP). Prepared by Life Systems, Inc. under subcontract to Clement International Corporation under contract no. 205-88-0608. U.S. Public Health Service. ATSDR/TP-92/05.

Agency for Toxic Substances and Disease Registry. 1993c. Toxicological Profile for Beryllium. Prepared by Syracuse Research Corporation under subcontract to Clement International Corporation under contract no. 205-88-0608. U.S. Public Health Service. ATSDR/TP-92/04.

Agency for Toxic Substances and Disease Registry. 1993d. Toxicological Profile for Cyanide. Prepared by Syracuse Research Corporation under subcontract to Clement International Corporation under contract no. 205-88-0608. U.S. Public Health Service. ATSDR/TP-92/09.

- Agency for Toxic Substances and Disease Registry. 1993e. Toxicological Profile for Polychlorinated Biphenyls. Prepared by Syracuse Research Corporation under subcontract to Clement International Corporation under contract no. 205-88-0608. U.S. Public Health Service. ATSDR/TP-92/16.
- Agency for Toxic Substances and Disease Registry. 1993f. Toxicological Profile for Methylene Chloride. Prepared by Life Systems, Inc. under subcontract to Clement International Corporation under contract no. 205-88-0608. U.S. Public Health Service. ATSDR/TP-92/13.
- Agency for Toxic Substances and Disease Registry. 1993g. Toxicological Profile for Endosulfan. Prepared by Clement International Corporation under contract no. 205-88-0608. U.S. Public Health Service. ATSDR/TP-91/16.
- Allen, J.R., D.H. Norback, and I.C. Hsu. 1974. Tissue Modifications in Monkeys as Related to Absorption, Distribution, and Excretion of Polychlorinated Biphenyls. *Arch. Environ. Contam. Toxicol.* 2:86-95.
- Alton, J.D. and J.F. Stritzke. 1973. *Weed Science.* 21:556-60. [Cited in Howard, 1991.]
- American Conference of Governmental Industrial Hygienists (ACGIH). 1994. Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices for 1994-1995. Cincinnati, OH.
- Anderson, H. and J. Amrhein. 1993. Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory. Prepared for the Great Lakes Fish Advisory Task Force. May.
- Anderson, M.A. and J.C. Parker. 1990. Sensitivity of Organic Contaminant Transport and Persistence Models to Henry's Law Constants: Case of Polychlorinated Biphenyls. *Water, Air, and Soil Pollution.* 5:1-18.
- AQUIRE (Aquatic Toxicity Information Retrieval). U.S. Environmental Protection Agency. Environmental Research Laboratories. Duluth, MN. August 1994 and February 1995 runs.
- Babish, J.G., G.S. Stoewsand, A.K. Furr, T.F. Parkinson, C.A. Bache, W.H. Gutenmann, P.C. Wszolek, and D.J. Lisk. 1979. Elemental and PCB Content of Tissues and Intestinal Aryl Hydrocarbon Hydroxylase Activity of Guinea Pigs Fed Cabbage Grown on Sewage Sludge. *J. Agric. Food. Chem.* 27(2):399-402.
- Baker, M.D. and C.I. Mayfield. 1980. *Water, Air, and Soil Pollution.* 13:411. [Cited in HSDB, 1994.]
- Bar-Yosef, B. and R. Rosenberg. 1988. Response of Corn and Tomato Plants to Fluorine Concentration in Solution Culture. *Agronomy Journal.* 80:173-177.



- Barnes, D.G. and M. Dourson. 1988. Reference Dose (RfD): Description and Use in Health Risk Assessments. *Reg. Tox. and Pharm.* 8:471-486.
- Barsotti, D.A. and J.P. Van Miller. 1984. Accumulation of a Commercial Polychlorinated Biphenyl Mixture (Aroclor 1016) in Adult Rhesus Monkeys and their Nursing Infants. *Toxicology*. 30:31-44. [Cited in ATSDR, 1993e].
- Bertrand, J.E., M.C. Lutrick, G.T. Edds, and R.L. West. 1981. Metal Residues in Tissues, Animal Performance and Carcass Quality with Beef Steers Grazing Pensacola Bahiagrass Pastures Treated with Liquid Digested Sludge. *J. Anim. Sci.* 53:146-153.
- Beyer, W.N. 1990. Evaluating Soil Contamination. U.S. Fish Wild. Serv., Biological Report 90(2). 25 pp.
- Bleavins, M.R., W.J. Breslin, R.J. Aulerich, et al. 1984. Placental and Mammary Transfer of a Polychlorinated Biphenyl Mixture (Aroclor 1254) in the European Ferret (*Mustela putorius furo*). *Environ. Toxicol. Chem.* 3:637-644.
- Bodek, I., W.J. Lyman, W.F. Reehl, and D.H. Rosenblatt. 1988. Environmental Inorganic Chemistry. Pergamon Press Inc., New York.
- Bohn, H.L. and G. Seekamp. 1979. Beryllium Effects on Potatoes and Oats in Acid Soils. *Water, Air, and Soil Pollution*. 11:319-322.
- Bowers, J.F., et al. 1980. Industrial Source Complex (ISC) Dispersion Model User's Guide (Vol. 1). PB80-133044. U.S. EPA. Research Triangle Park, NC.
- Boyd, S.A., D.R. Shelton, D. Berry, and J.M. Tiedje. 1983. Anaerobic Biodegradation of Phenolic Compounds in Digested Sludge. *Applied Environmental Microbiology*. 46:50-54. [Cited in HSDB, 1994.]
- Branson, D.R., I.T. Takahashi, W.M. Parker, and G.E. Blau. 1985. Bioconcentration Kinetics of 2,3,7,8-Tetrachlorodibenzo-*p*-Dioxin in Rainbow Trout. *Environmental Toxicology and Chemistry*. 4:779-788.
- Bray, B.J., R.H. Dowdy, R.D. Goodrich, and D.E. Pamp. 1985. Metal Accumulation in Tissues of Goats Fed Silage Produced on Sewage-Sludge Amended Soil. *J. Environ. Qual.* 14:114-118.
- Bridie, A.L., C.J.M. Wolff, and M. Winter. 1979. BOD and COD of Some Petrochemicals. *Water Res.* 13:627-30. [Cited in HSDB, 1994.]
- Brown, J.F. and R.W. Lawton. 1984. Polychlorinated Biphenyl Partitioning Between Adipose Tissue and Serum. *Bull. Environ. Contamin. Toxicol.* 33:277-280.

- Butte, N.F., C. Garza, J.E. Stuff, E.O. Smith, and B.L. Nichols. 1984. Effect of Maternal Diet and Body Composition on Lactational Performance. *American Journal of Clinical Nutrition*. 39:296-306. [Cited in Smith, 1987.]
- Callahan, C.A., M.A. Shirazi, and E.F. Neuhauser. 1994. Comparative Toxicity of Chemicals to Earthworms. *Environmental Toxicology and Chemistry*. 13(2):291-298.
- Chaney, R. 1992. U.S. Department of Agriculture. Personal Communication.
- Chaney, R.L., G.S. Stoewsand, A.K. Furr, C.A. Bache, and D.J. Lisk. 1978. Elemental Content of Tissues of Guinea Pigs Fed Swiss Chard Grown on Municipal Sewage Sludge Amended Soil. *J. Agric. Food Chem.* 26(4):994-997.
- Chaney, R.L., J.A. Ryan, and G.A. O'Connor. 1991. Risk Assessment for Organic Micropollutants: U.S. Point of View. In: P. L'Hermite et al. (eds). *Proc. EEC Symp. Treatment and Use of Sewage Sludge and Liquid Agricultural Wastes*. Athens, Greece, Sept. 1990.
- Chaney, R.L., R.J.F. Bruins, D.E. Baker, R.F. Korcak, J.E. Smith, Jr., and D.W. Cole. 1987. Transfer of Sludge-Applied Trace Elements to the Food Chain. pp. 67-99. In: A.L. Page, T.J. Logan, and J.A. Ryan (eds.). *Land Application of Sludge-Food Chain Implications*. Lewis Publishers Inc., Chelsea, MI.
- Chou, W.L., et al. 1979. *Bioengineering Symposium*. 8:391-414. [Cited in HSDB, 1994.]
- Davis, J.W. and S.S. Madsen. 1991. The Biodegradation of Methylene Chloride in Soils. *Environmental Toxicology and Chemistry*. 10:463-474.
- Davis, R.D. 1980. Uptake of Fluoride by Ryegrass Grown in Soil Treated with Sewage Sludge. *Environ. Pollut.* 1:277-284.
- Decker, A.M., R.L. Chaney, J.P. Davidson, T.S. Rumsey, S.B. Mohanty and R.C. Hammond. 1980. Animal Performance on Pastures Topdressed with Liquid Sewage Sludge and Sludge Compost. pp. 37-41. In: *Proc. Nat'l Conf. Municipal and Industrial Sludge Utilization and Disposal*. Information Transfer, Inc., Silver Spring, MD.
- Denduluri, S. 1993. Reduction of Manganese Accumulation by EDTA and NTA in Okra (*Abelmoschus esculentus* L.) Grown in Sewage-Irrigated Soil. *Bull. Environ. Contam. Toxicol.* 52:438-443.
- Devillers, J. and J.M. Exbrayat. 1992. *Ecotoxicity of Chemicals to Amphibians*. Gordon and Breach Science Publishers, Philadelphia, PA. 351 pp.
- Dojlido, J.R. 1979. Investigation of Biodegradability and Toxicity of Organic Compounds: Final Report 1975-79. USEPA-600/2-79-163. [Cited in HSDB, 1994.]

- Domingo, J.L., J.M. Llobet, J.M. Tomas, et al. 1985. Short-Term Toxicity Studies of Vanadium in Rats. *J. Appl. Toxicol.* 5:418-421. [Cited in ATSDR, 1992i].
- Domingo, J.L., J.M. Llobet, M. Gomez, et al. 1987. Nutritional and Toxicological Effects of Short-Term Ingestion of Aluminum by the Rat. *Res. Commun. Chem. Pathol. Pharmacol.* 56:409-419. [Cited in ATSDR, 1992a].
- Dose, M., et al. 1975. *Trib. Cebedeau.* 28:3-11. [Cited in HSDB, 1994.]
- Doss, G.J., L.E. St. John, Jr., and D.J. Lisk. 1977. Studies of Fluoride Absorption by Plants Grown in Perlite. *Bulletin of Env. Contam. and Tox.* 18(3):366-369.
- Dowdy, R.H. and W.E. Larson. 1975. The Availability of Sludge Borne Metals to Various Vegetable Crops. *J. Environ. Quality.* 4:278-82.
- Downs, W.L., J.K. Scott, L.T. Steadman, et al. 1960. Acute and Sub-Acute Toxicity Studies of Thallium Compounds. *Am. Ind. Hyg. Assoc. J.* 21:399-406. [Cited in ATSDR, 1992i.]
- Eckert, J.W. 1962. *Phytopathology.* 52:642-649. [Cited in HSDB, 1994.]
- Edwards, C.A. and P.J. Bohlen. 1992. The Effects of Toxic Chemicals on Earthworms. *Reviews of Environmental Contamination and Toxicology.* 125:23-99.
- El-Kherbawy, M. and J. Sanders. 1984. Effects of pH and Phosphate Status of a Silty Clay Loam on Mn, Zn, and Cu Concentrations in Soil Fractions and in Clover. *J. Sci. Food. Agric.* 35:733-739.
- Elliot, S. 1989. *Atmos. Environ.* 23:1977-80. [Cited in HSDB, 1994.]
- Environmental Science and Engineering. 1985. Exposure to Airborne Contaminants Released from Land Disposal Facilities--A Proposed Methodology. Prepared by Environmental Science and Engineering, Gainesville, FL for the U.S. EPA Office of Solid Wastes, Washington, DC.
- Fries, G.F. 1982. Potential Polychlorinated Biphenyl Residues in Animal Products From Application of Contaminated Sewage Sludge to Land. *Journal of Environmental Quality.* 11(1):14-20.
- Ganning, A.E., M.J. Olsson, U. Brunk, et al. 1991. Effects of Prolonged Treatment with Phthalate Ester on Rat Liver. *Pharmacol. Toxicol.* 68:392-401. [Cited in ATSDR, 1993b.]
- Gerhart, J.M. 1987. Ninety-Day Oral Toxicity Study of Potassium Silver Cyanide ([KAg(CN)<sub>2</sub>] in Sprague-Dawley Rats. Prepared for The Dynamac Corporation, Rockville, MD by IIT Research Institute, Chicago, IL. IITRI Project No. L06183, Study No. 4. [Cited in ATSDR, 1993d.]

- Gerritse, R.G., R. Vriesema, J.W. Dalenberg, and H.P. De Roos. 1982. Effect of Sewage Sludge on Trace Element Mobility in Soils. *Journal of Environmental Quality*. 11(3):359-364.
- Gile, J.D. and J.W. Gillett. 1979. *J. Agric. Chem.* 27:1159-1164. [Cited in HSDB, 1994.]
- Gillett, J.W. 1994. Cornell University, Ithaca, New York. Phone conversation with Michael Wise, Abt Associates Inc. August 22.
- Greve, P.A. and S.L. Wit. 1971. *Journal of the Water Pollution Control Federation*. 42:2338-48. [Cited in HSDB, 1994.]
- Hansch, C. and A.J. Leo. 1979. *Substituent Constants for Correlation Analysis in Chemistry and Biology*. John Wiley and Sons, New York, NY. [Cited in ATSDR, 1993f.]
- Hansch, C. and A.J. Leo. 1981. Medchem Project. Pomona College, Claremont, CA. Issue No. 19. [Cited in HSDB, 1994.]
- Hansch, C. and A.J. Leo. 1985a. Medchem Project. Pomona College, Claremont, CA. Issue No. 26. [Cited in Howard, 1991, in ATSDR, 1992g, and in HSDB, 1994.]
- Hansch, C. and A.J. Leo. 1985b. *Substituent Constants for Correlation Analysis in Chemistry and Biology*. John Wiley and Sons, Inc. New York. [Cited in ATSDR, 1989.]
- Harfenist, A., T. Power, K.L. Clark, and D.B. Peakall. 1989. A Review and Evaluation of the Amphibian Toxicological Literature. Technical Report Series No. 61. Canadian Wildlife Service Headquarters. 222 pp.
- Hartenstein, R., E.F. Neuhauser, and A. Narahara. 1981. Effects of Heavy Metal and Other Elemental Additives to Activated Sludge on Growth of *Eisenia foetida*. *Journal of Environmental Quality*. 10(3):372-376.
- Hasset, J.J, W.L. Banwart, and R.A. Griffin. 1983. *Environment and Solid Wastes: Characterization, Treatment, and Disposal*. Edited by Francis, C.W., S.I. Auerbach, and V.A. Jacobs. Butterworth Publishers, Woburn, MA. pp. 161-175.
- Hawley's Condensed Chemical Dictionary. 1993. R.J. Lewis, Sr. (ed.). 12th ed. Van Nostrand Reinhold, New York.
- Hazardous Substances Data Base (HSDB). 1994. Chemical files on-line from Toxnet.
- Healy, J.B. and L.Y. Young. 1978. Catechol and Phenol Degradation by a Methanogenic Population of Bacteria. *Food Microbiology and Toxicology*. 35:216-8. [Cited in HSDB, 1994.]

- Helmke, P.A., W.P. Robarge, R.L. Korotev, and P.J. Schomberg. 1979. Effects of Soil-Applied Sewage Sludge on Concentrations of Elements in Earthworms. *Journal of Environmental Quality*. 8(3):322-327.
- Henry, J.G. and G.W. Heinke. 1989. *Environmental Science and Engineering*. Prentice Hall. Englewood Cliffs, N.J.
- Heukelekian, H. and M.C. Rand. 1955. *Journal of Water Pollution Control Association*. 29:1040-53. [Cited in HSDB, 1994.]
- Hine, J. and P.K. Mookerjee. 1975. The Intrinsic Hydrophilic Character of Organic Compounds. Correlations in Terms of Structural Contributions. *J. Org. Chem.* 40(3):292-298.
- Hornshaw, T.C., R.J. Aulerich, and R.K. Ringer. 1986. Toxicity of *o*-Cresol to Mink and European Ferrets. *Environ. Toxicol. Chem.* 5(8):713-720. [Cited in ATSDR, 1992g.]
- Horowitz, A., D.R. Shelton, C.P. Cornell, and J.M. Tiedje. 1982. Anaerobic Degradation of Aromatic Compounds in Sediment and Digested Sludge. *Dev. Ind. Microbiology*. 23:435-444. [Cited in Howard et al., 1991.]
- Howard, P.H. (ed.). 1991. *Handbook of Environmental Fate and Exposure Data for Organic Chemicals*. Lewis Publishers, Inc., Chelsea, Michigan.
- Howard, P.H., S. Banerjee, and K.H. Robillard. 1985. Measurement of Water Solubilities, Octanol/Water Partition Coefficients and Vapor Pressures of Commercial Phthalate Esters. *Environ. Toxicol. Chem.* 4:653-661. [Cited in ATSDR, 1993b.]
- Howard, P.H., R.S. Boethling, W.F. Jarvis, W.M. Meylan, and E.M. Michalenko. 1991. *Handbook of Environmental Degradation Rates*. Lewis Publishers, Inc., Chelsea, Michigan.
- Hue, N.V. 1988. A Possible Mechanism for Manganese Phytotoxicity in Hawaii Soils Amended with a Low-Manganese Sewage Sludge. *J. Environ. Quality*. 17:473-79.
- Hwang, S.T. 1982. Toxic Emissions From Land Disposal Facilities. *Environmental Progress*. 1(1):46-52.
- Hwang, S.T. 1985. Model Prediction of Volatile Emissions. *Environmental Progress*. 4(2):141-144.
- Hwang, S.T. and J.W. Falco. 1986. Estimation of Multimedia Exposures Related to Hazardous Waste Facilities. In: Y. Cohen (ed.). *Pollutants in a Multimedia Environment*. Plenum Publishing Co., New York.

- Johnson, B.T. and W. Lulves. 1975. Biodegradation of Di-n-Butyl Phthalate and Di-2-Ethylhexyl Phthalate in Freshwater Hydrosoil. *Journal of Fish. Res. Board of Canada*. 32:333-339. [Cited in HSDB, 1994.]
- Jones-Price, C., R. Tyl-Wolkowski, M.C. Marr, et al. 1984. Teratologic Evaluation of Carbon Disulfide (CAS No. 75-15-0) Administered to New Zealand White Rabbits on Gestational Days 6 through 19. Research Triangle Park, NC: National Center for Toxicological Research, Division of Teratogenesis Research. NCTR 222-80-2031(C); NTIS PB84-0192350. [Cited in ATSDR, 1992f.]
- Jury, W.A., et al. 1987. *Rev. Environ. Contam. Toxicol.* 99:119-164. [Cited in Howard, 1991.]
- Kalbasi, M., F. Filsoof, and y. Rezai-Nejad. 1988. Effect of Sulfur Treatments on Yield and Uptake of Fe, Zn, and Mn by Corn, Sorghum, and Soybeans. *Journal of Plant Nutrition*. 11(6-11):1353-1360.
- Kaplan, D.I., D.C. Adriano, and K.S. Sajwan. 1990. Thallium Toxicity in Beans. *Journal of Environmental Quality*. 19(3):359-365.
- Khattak, R.A. and W.M. Jarrell. 1989. Effect of Saline Irrigation Waters on Soil Manganese Leaching and Bioavailability to Sugar Beets. *Soil Sci. Soc. Am. J.* 53:142-146.
- Klopffer, W., et al. 1982. *Ecotox Environ. Safety*. 6:294-301. [Cited in HSDB, 1994.]
- Kociba, R.J., D.G. Keyes, J.E. Beyer, R.M. Carreon, C.E. Wade, D.A. Dittenber, R.P. Kalnins, L. Frauson, C.N. Park, S.D. Barnard, R.A. Hummell, and G.C. Humiston. 1978. Results of a Two-Year Chronic Toxicity and Oncogenicity Study of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) in Rats. *Tox. and Appl. Pharm.* 46:279-303.
- Kosak-Channing, L. 1986. Beryllium Distribution in Hydroponically-Grown Tobacco Plants. *Plant Science*. 46:175-180.
- Laskey, J.W., G.L. Rehnberg, J.F. Hein, et al. 1982. Effects of Chronic Manganese ( $Mn_3O_4$ ) Exposure on Selected Reproductive Parameters in Rats. *J. Toxicol. Environ. Health*. 9:677-687. [Cited in ATSDR, 1992h.]
- Linehan, D.J. 1984. Micronutrient Cation Sorption by Roots and Uptake by Plants. *Journal of Experimental Botany*. 35:1571-1574.
- Liu, D., W.M.J. Strachan, K. Thomson, and K. Kwasniewska. 1981. Determination of the Biodegradability of Organic Compounds. *Environmental Science and Technology*. 15(7):788-93.
- Lyman, W.J., W.F. Reehl, and D.H. Rosenblatt. 1990. *Handbook of Chemical Property Estimation Methods*. American Chemical Society, Washington, DC.

- Mabey, W.R., J.H. Smith, R.T. Podoll, et al. 1982. Aquatic Fate Process Data for Organic Priority Pollutants. Washington, DC: U.S. EPA, Office of Water Regulations and Standards. EPA-440/4-81-014. PB87-169090. [Cited in ATSDR, 1992k, 1993f, 1993g.]
- Mackay, D. and P.J. Leinonen. 1975. Rate of Evaporation of Low-Solubility Contaminants From Water Bodies to Atmosphere. *Environmental Science and Technology*. 9(13):1178-1180.
- Mackay, D. and A. Yeun. 1983. Mass Transfer Coefficient Correlations for Volatilization of Organic Solutes from Water. *Environmental Science and Technology*. 17(4):423-429.
- McCall, P.J., et al. 1981. *Journal of Agriculture and Food Chemistry*. 29:100-7. [Cited in Howard, 1991.]
- Menzie, C.A., D.E. Burmaster, J.S. Freshman, and C.A. Callahan. 1992. Assessment of Methods for Estimating Ecological Risk in the Terrestrial Component: A Case Study at the Baird & McGuire Superfund Site in Holbrook, Massachusetts. *Environmental Toxicology and Chemistry*. 11:245-260.
- Merck Index. 1989. S. Budavari, M.J. O'Neil, A. Smith, and P.E. Heckelman (eds.). 11th ed. Merck & Co., Inc., Rahway, NJ.
- Montgomery, J.H. and L.M. Welkom. 1990. Groundwater Chemicals Desk Reference. Lewis Publishers, Inc., Chelsea, Michigan. [Cited in ATSDR, 1993b.]
- Muchovej, R.M.C., V.G. Allen, D.C. Martens, L.W. Zelazny, and D.R. Notter. 1986. Aluminum, Citric Acid, Nitrotriactic Acid, and Soil Moisture Effects on Aluminum and Iron Concentrations in Ryegrass. *Agron. J.* 78:138-145.
- Murphy, T.J., et al. 1987. *Environmental Science and Technology*. 21:155-162. [Cited in HSDB, 1994.]
- Murray, F.J., F.A. Smith, K.D. Nitschke, C.G. Humiston, R.J. Kociba, and B.A. Schwetz. 1979. Three-Generation Reproduction Study of Rats Given 2,3,7,8-TCDD in the Diet. *Tox. and Appl. Pharm.* 50:241-252.
- NCI. 1980. Bioassay of Phenol for Possible Carcinogenicity. Bethesda, MD: U.S. Department of Health and Human Services, National Cancer Institute. NCI-CG-TR-203. [Cited in ATSDR, 1989.]
- Neuhauser, E.F. and C.A. Callahan. 1990. Growth and Reproduction of the Earthworm *Eisenia fetida* Exposed to Sublethal Concentrations of Organic Chemicals. *Soil Biochemistry*. 22(2):175-179.

- NTP. 1990. National Toxicology Program Technical Report Series Toxicology and Carcinogenesis Studies of Toluene (CAS No. 108-88-3) in F344/N Rats and 86C3F Mice (Inhalation Studies). Research Triangle Park, NC: U.S. Environmental Protection Agency, Department of Health and Human Services, No. 371. PB90-256371. [Cited in ATSDR, 1992k.]
- O'Connor, G. 1992. Professor and Chairman, Soil and Water Science Dept., University of Florida. Personal Communication.
- OHM/TADS. 1989. Oil and Hazardous Materials/Technical Assistance Data System. Chemical Information Systems. September 14, 1989. [Cited in ATSDR, 1993g.]
- Ou, Li-Tse. 1984. 2,4-D Degradation and 2,4-D Degrading Microorganisms in Soils. Soil Science. 137(2):100-7.
- Perry, H.M., Jr., S.J. Kopp, M.W. Erlanger, et al. 1983. Cardiovascular Effects of Chronic Barium Ingestion. Trace Subst. Environ. Health. 17:155-164. [Cited in ATSDR, 1992c.]
- Perry, H.M., Jr., S.J. Kopp, E.F. Perry, et al. 1989. Hypertension and Associated Cardiovascular Abnormalities Induced by Chronic Barium Feeding. J. Toxicol. Environ. Health. 28:373-388. [Cited in ATSDR, 1992c.]
- Perry, H.M., Jr., E.F. Perry, M.W. Erlanger, et al. 1985. Barium-Induced Hypertension. Adv. Mod. Environ. Toxicol., Inorg. Drinking Water Cardio. Vasc. Dis. 9:221-229. [Cited in ATSDR, 1992c.]
- Peyton, T.O., et al. 1976. Carbon Disulfide, Carbonyl Sulfide Literature Review and Environmental Assessment. USEPA-600/9-78-009. [Cited in HSDB, 1994.]
- Price, K.S., et al. 1974. Journal of Water Pollution Control Federation. 46:63-77. [Cited in HSDB, 1994.]
- Que Hee, S.S., et al. 1981. The Phenoxyalkanoic Herbicides. Vol. 1. Chem. Anal. Environ. Pollution. CRC Press Inc., Boca Raton, FL. [Cited in HSDB, 1994.]
- Ralston, W., R. Hilderbrand, D. Uddin, et al. 1985. Potential of 2,5-Hexanedione Neurotoxicity by Methyl Ethyl Ketone. Toxicol. Appl. Pharmacol. 81:319-327. [Cited in ATSDR, 1992e.]
- Rathburn, R.E. and D.Y. Tai. 1987. Vapor Pressures and Gas-Film Coefficients for Ketones. Chemosphere. 16:69-78. [Cited in ATSDR, 1992e.]
- Rhee, G.Y., et al. 1989. Water Res. 23(8):957-64. [Cited in HSDB, 1994.]
- Roberts, B.L. and H.W. Dorough. 1984. Relative Toxicities of Chemicals to the Earthworm *Eisenia foetida*. Environmental Toxicology and Chemistry. 3:67-78.



- Roberts, B.L. and H.W. Dorough. 1985. Hazards of Chemicals to Earthworms. *Environmental Toxicology and Chemistry*. 4:307-323.
- Romney, E.M., A. Wallace, R. Wood, A.M. El-Gazzar, J.D. Childress, and G.V. Alexander. 1977. Role of Organic Matter in a Desert Soil on Plant Response to Ag, W, Co, and Pb. *Commun. in Soil Science and Plant Analysis*. 8(9):719-725.
- Rungby, J. and G. Danscher. 1984. Hypoactivity in Silver Exposed Mice. *Acta Pharamcol. Toxicol.* 55:398-401. [Cited in ATSDR, 1990.]
- Sattar, M.A. and J. Paasivirta. 1980. *Chemosphere*. 9:745-752. [Cited in HSDB, 1994.]
- Schmid, P. and C. Schlatter. 1985. Excretion and Metabolism of Di(2-Ethylhexyl)Phthalate in Man. *Xenobiotica*. 15(3):251-256.
- Schroeder, H.A., J.J. Balassa, and W.H. Vinton, Jr. 1964. Chromium, Lead, Cadmium, Nickel, and Titanium in Mice: Effect on Mortality, Tumors, and Tissue Levels. *J. Nutrit.* 83:239-250. [Cited in WHO, 1982.]
- Schroeder, H.A., M. Kanisawa, D.V. Frost, et al. 1968. Germanium, Tin, and Arsenic in Rats: Effects on Growth, Survival, Pathological Lesions, and Life Span. *J. Nutr.* 96:37-45. [Cited in ATSDR, 1992j.]
- Schroeder, H.A. and M. Mitchener. 1975. Life-term Studies in Rats: Effects of Aluminum, Barium, Beryllium, and Tungsten. *J. Nutr.* 105:421-427. [Cited in ATSDR, 1992c.]
- Schroeder, H.A., M. Mitchener, and A.P. Nason. 1970. Zirconium, Niobium, Antimony, Vanadium, and Lead in Rats: Life-Time Studies. *J. Nutr.* 100:59-68. [Cited in ATSDR, 1992b.]
- Schwartz, H.E., et al. 1979. *International Journal of Environmental Analytical Chemistry*. 6:133-144. [Cited in HSDB, 1994.]
- Schwarzenbach, R.P., P.M. Gschwend, and D.M. Imboden. 1993. *Environmental Organic Chemistry*. John Wiley & Sons, Inc. New York.
- Serota, D.G., A.K. Thakur, B.M. Ulland, et al. 1986. A Two-Year Drinking-Water Study of Dichloromethane in Rodents. I. Rats. *Food Chem. Toxicol.* 24:951-958. [Cited in ATSDR, 1993f.]
- Shelton, D.R., S.A. Boyd, and J.M. Tiedje. 1984. Anaerobic Biodegradation of Phthalic Acid Esters in Sludge. *Environmental Science and Technology*. 18:93-97. [Cited in Howard et al., 1991.]
- Shen, T.T. 1982. Estimation of Organic Compound Emissions From Waste Lagoons. *Journal of the Air Pollution Control Association*. 32(1):79-82.

- Singh, A., R. Chhabra, and I.P. Abrol. 1979a. Effect of Fluorine and Phosphorous on the Yield and Chemical Composition of Rice Grown in Soils of Two Sodicities. *Soil Science*. 127(2):86-93.
- Singh, A., R. Chhabra, and I.P. Abrol. 1979b. Effect of Fluorine and Phosphorous Applied to a Sodic Soil on Their Availability and on Yield and Chemical Composition of Wheat. *Soil Science*. 128(2):90-97.
- Sjoberg, et al. 1985. [Cited in ATSDR, 1993b.]
- Smith, A.E. 1978. Relative Persistence of Di- and Tri-Chlorophenoxyalkanoic Acid Herbicides in Saskatchewan Soils. *Weed Res.* 18:275-9. [Cited in Howard et al., 1991, and HSDB, 1994.]
- Smith, A.E. 1979. Soil Persistence Experiments with <sup>(14C)</sup>2,4-D in Herbicidal Mixtures and Field Persistence Studies with Tri-Allate and Trifluralin Both Singly and Combined. *Weed Res.* 19:165-170. [Cited in Howard et al., 1991.]
- Smith, A.H. 1987. Infant Exposure Assessment for Breast Milk Dioxins and Furans Derived From Waste Incineration Emissions. *Risk Analysis*. 7(3):347-353.
- Snider, J.R. and G.A. Dawson. 1985. *Journal of Geophys. Res. (Atmosphere)*. 90(D):3797-805. [Cited in HSDB, 1994.]
- Soon, Y.K. and T.E. Bates. 1985. Molybdenum, Cobalt, and Boron Uptake from Sewage Sludge Amended Soils. *Can. J. Soil Sci.* 65:507-17.
- Springer, C., P.D. Lunney, and K.T. Valsaraj. 1984. Emission of Hazardous Chemicals From Surface and Near Surface Impoundments to Air. U.S. EPA, Solid and Hazardous Waste Research Division, Cincinnati, OH. Project Number 808161-02.
- Stark, J.M. and E.F. Redente. 1990. Plant Uptake and Cycling of Trace Elements on Retorted Oil Shale Disposal Piles. *J. Environ. Qual.* 19:495-501.
- Thomann, R.J. and J.A. Mueller. 1987. *Principles of Surface Water Quality Modeling and Control*. Harper and Row, New York.
- Timson, B.F. and J.L. Coffman. 1984. Body Composition by Hydrostatic Weighing at Total Lung Capacity and Residual Volume. *Medicine and Science in Sports Exercise*. 16:411-414. [Cited in Smith, 1987.]
- Tonkonozhenko, Y.V. and M.I. Khlyupina. 1974. Titanium in the Soils and Plants of Krasnodar Kray. *Soviet Soil Science (Pochvovedeniye)*. 3:38-45.
- U.S. Department of Agriculture (USDA). 1987. Summary Report: National Resources Inventory. Statistical Bulletin Number 790. Soil Conservation Service.

- U.S. EPA. 1978. Process Design Manual for Municipal Sludge Landfills. Office of Solid Waste. EPA-625/1-78-010/SW-705.
- U.S. EPA. 1982. Fate of Priority Pollutants in Publicly-Owned Treatment Works. Vol. I. Effluent Guidelines Division, Washington, DC. EPA 440/1-82-303.
- U.S. EPA. 1984. Environmental Regulations and Technology: Use and Disposal of Municipal Wastewater Sludge. Prepared by the U.S. EPA Intra-Agency Sludge Task Force. EPA 625/10-84-003. September.
- U.S. EPA. 1985. Summary of Environmental Profiles and Hazard Indices for Constituents of Municipal Sludge: Methods and Results. Washington, DC. Office of Water.
- U.S. EPA. 1986a. Report to Congress on the Discharge of Hazardous Wastes to Publicly Owned Treatment Works. EPA/530-SW-86-004.
- U.S. EPA. 1986b. Cancer Risk Assessment Guidelines. CFR 51(185):33992-34003. September 24.
- U.S. EPA. 1986c. Industrial Source Complex (ISC) Dispersion Model User's Guide. Second Edition. U.S. EPA, EPA 450/4-86-005a and 005b. Research Triangle Park, NC.
- U.S. EPA. 1986d. Research and Development: Development of Risk Assessment Methodology for Municipal Sludge Landfilling. Prepared by Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Water Regulations and Standards. ECAO-CIN-485.
- U.S. EPA. 1987a. Ambient Aquatic Life Water Quality Criteria for Silver. Draft. Environmental Research Laboratories, Duluth, MN and Narragansett, RI. September.
- U.S. EPA. 1987b. Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)--Air Emissions Models. Office of Air Quality Planning and Standards, Research Triangle Park, NC. EPA-450/3-87-026.
- U.S. EPA. 1988a. Ambient Water Quality Criteria for Aluminum--1988. EPA 440/5-86-008. August.
- U.S. EPA. 1988b. Ambient Aquatic Life Water Quality Criteria for Antimony (III). Draft. Environmental Research Laboratories, Duluth, MN and Narragansett, RI. August.
- U.S. EPA. 1988c. Recommendations for and Documentation of Biological Values for Use in Risk Assessment. Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, Office of Research and Development. EPA/600/6-87/008. February.
- U.S. EPA. 1989a. 1988 National Sewage Sludge Survey. Office of Water.

- U.S. EPA. 1989b. Development of Risk Assessment Methodology for Land Application and Distribution and Marketing of Municipal Sludge. Office of Research and Development, Cincinnati, OH. EPA/600/6-89/001.
- U.S. EPA. 1989c. PC-GEMS Database. User's Guide, Release 1.0. Prepared by General Sciences Corporation for the Office of Pesticides and Toxic Substances. Contract No. 68024281.
- U.S. EPA. 1989d. Risk of Unsaturated/Saturated Transport and Transformation of Chemical Concentrations (RUSTIC), Volume II: User's Guide. Environmental Research Laboratory, Athens, GA. EPA/600/3-89/048b.
- U.S. EPA. 1989e. Background Document for the Surface Impoundment Modeling System (SIMS). Control Technology Center. Research Triangle Park, NC. EPA/600-6-89-001. NTIS PB90-135740/A5.
- U.S. EPA. 1989f. Screening Study for Wildlife Criteria Development. Office of Water, Office of Water Regulations and Standards.
- U.S. EPA. 1989g. Risk of Unsaturated/Saturated Transport and Transformation Interactions for Chemical Concentrations (RUSTIC), Volume I: Theory and Code Verification. Prepared by Woodward Clyde Consultants, HydroGeologic, and AQUA TERRA Consultants for the Office of Research and Development, Environmental Research Laboratory, Athens, GA. Contract No. 68-03-6304.
- U.S. EPA. 1989h. Technical Support Document: Incineration of Sewage Sludge (Proposal). Office of Water.
- U.S. EPA. 1989i. Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-Dioxins and Dibenzofurans (CDDs and CDFs). A 1989 Update. U.S. EPA Risk Assessment Forum, Washington, DC. EPA 6253-89-016.
- U.S. EPA. 1990a. Development of Risk Assessment Methodology for Surface Disposal of Municipal Sludge. Prepared by Abt Associates Inc. for the Environmental Criteria Assessment Office, Office of Research and Development, Cincinnati, OH. ECAO-CIN-750.
- U.S. EPA. 1990b. Guidance On: Assessment and Control of Bioconcentratable Contaminants in Surface Waters. DRAFT.
- U.S. EPA. 1990c. National Sewage Sludge Survey; Availability of Information and Data, and Anticipated Impacts on Proposed Regulations; Proposed Rule. 40 CFR Part 503, Washington, DC.
- U.S. EPA. 1990d. Implementation of a Chemical Ranking System. Draft Final Report. Criteria and Standards Division. EPA Contract #68-03-3534. May 24.

- U.S. EPA. 1991a. Human Health Risk Assessment for Dioxin in Pulp and Paper Sludge: Technical Support Document for the Proposed Land Application Rule. April.
- U.S. EPA. 1991b. PIRANHA. Version 2.0. Environmental Research Laboratory, Office of Research and Development.
- U.S. EPA. 1992a. Technical Support Document for Land Application of Sewage Sludge. Office of Water, Office of Science and Technology. EPA 822/R-93-001a. November.
- U.S. EPA. 1992b. Technical Support Document for Sewage Sludge Incineration. Office of Water. EPA 822/R-93-003. November.
- U.S. EPA. 1992c. Technical Support Document for the Surface Disposal of Sewage Sludge. Office of Water. EPA 822/R-93-002. November.
- U.S. EPA. 1992d. Estimating Exposure to Dioxin-Like Compounds. Review Draft. Office of Research and Development. EPA/600/6-88/005B. August.
- U.S. EPA. 1993a. Human Health Risk Assessment for the Use and Disposal of Sewage Sludge: Benefits of Regulation. Prepared by Abt Associates Inc. under contract no. 68-C0-0093 for the Office of Water. January.
- U.S. EPA. 1993b. Comparison and Rank of Proposed Human Health Bioaccumulation Factors for the Great Lakes Initiative. EPA-822-R-93-010. Office of Water. August.
- U.S. EPA. 1994a. Revision of Assessment of Risks to Terrestrial Wildlife from TCDD and TCDF in Pulp and Paper Sludge. Prepared by Abt Associates Inc. under contract no. 68-C0-0093 for the Office of Pollution Prevention and Toxics. December.
- U.S. EPA. 1994b. Estimating Exposure to Dioxin-Like Compounds. Volume II: Properties, Sources, Occurrence and Background Exposures. Office of Health and Environmental Assessment. June. EPA/600/6-88/005Cb. External Review Draft.
- U.S. EPA. 1994c. Health Assessment Document for 2,3,7,8 - Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds. Volume II. EPA/600/BP-92/001b. External Review Draft. June.
- U.S. Geological Survey. 1992. Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States. H.T. Shacklette and J.G. Boerngen. U.S. Geological Survey Professional Paper 1270. Second printing.
- Vanoni, Vita A. (ed.). 1975. Sedimentation Engineering. Prepared by the ASCE Task Committee for the Preparation of the Manual on Sedimentation of the Sedimentation Committee of the Hydraulics Division, New York, NY.

- Verschueren, K. 1983. Handbook of Environmental Data on Organic Chemicals. Van Nostrand Reinhold Co., New York, NY. 2nd ed. [Cited in ATSDR, 1992f, 1993b.]
- Voight, G., K. Henrichs, G. Prohl, and H.G. Paretzke. 1988. Measurements of Transfer Coefficients for <sup>137</sup>Cs, <sup>60</sup>Co, <sup>54</sup>Mn, <sup>22</sup>Na, <sup>131</sup>I and <sup>95m</sup>Tc from Feed into Milk and Beef. Radiation and Environmental Biophysics. 27:153-164.
- Walton, K.C. 1987. Effects of Treatment with Sodium Fluoride and Subsequent Starvation on Fluoride Content of Earthworms. Bulletin of Environmental Contamination and Toxicology. 38:163-170.
- Wang, C.H. and F.E. Broadbent. 1972. Kinetics of Losses of PCNB and DCNA in Three California Soils. Soil Sci. Soc. Amer. Proc. 36:742-745.
- Weast, R.C. (ed.). 1990. CRC Handbook of Chemistry and Physics. 70th ed. CRC Press, Inc., Boca Raton, FL.
- Webber, M.D., H.D. Monteith, and D.G.M. Corneau. 1983. Assessment of Heavy Metals and PCBs at Sludge Application Sites. Journal of the Water Poll. Control Fed. 55(2):187-195.
- Weir, R.J., Jr. and R.S. Fisher. 1972. Toxicologic Studies on Borax and Boric Acid. Toxicol. Appl. Pharmacol. 23:351-364. [Cited in ATSDR, 1992d.]
- Whelan, B.R. 1993. Effect of Barium Selenate Fertilizer on the Concentration of Barium in Pasture and Sheep Tissues. J. Agric. Food Chem. 41:768-770.
- Whitehead, R.G. and A.A. Paul. 1981. Infant Growth and Human Milk Requirements. Lancet. 2:161-163. [Cited in Smith, 1987.]
- WHO. 1982. World Health Organization. Environmental Health Criteria 24: Titanium. Geneva.
- Wilson, J.T., J.F. McNabb, D.L. Balkwill, and W.C. Ghiorse. 1983. Enumeration and Characterization of Bacteria Indigenous to a Shallow Water-Table Aquifer. Ground Water. 21(2):134-142.
- Yakushiji, T., I. Watanabe, K. Kuwabura, et al. 1978. Long-Term Studies of the Excretion of Polychlorinated Biphenyls (PCBs) Through the Mother's Milk of an Occupationally Exposed Worker. Arch. Environ. Contam. Toxicol. 7:493-504. [Cited in ATSDR, 1993e.]
- Yeh, G.T. 1981. AT123D: Analytical Transport One-, Two-, and Three-Dimensional Simulation of Waste Transport in the Aquifer System. Oak Ridge National Laboratory, Environmental Sciences Division. Publication No. 1439. March.

## **APPENDIX A**

### **ANALYSIS OF POLLUTANTS DETECTED LESS THAN TEN PERCENT OF THE TIME**

## Introduction

EPA conducted two screening analyses to determine if any of the 69 pollutants detected less than ten percent of the time in sewage sludge might still pose an unacceptable risk to human health. For the first screening analysis, EPA used the algorithms from agricultural Pathway 3. This pathway tends to result in high risk because small children are directly ingesting sewage sludge, without any of the mitigating influences of degradation, dilution, etc. found in other pathways. For the second screening analysis, EPA evaluated other pathways for pollutants with relatively large cancer potency slopes, or  $q_1^*$  values.

To conduct these analyses, human toxicity data were needed. Exhibit A-1 presents the available human toxicity data for the 69 pollutants as well as each pollutant's frequency of detection, as measured in the 1988 National Sewage Sludge Survey (U.S. EPA, 1989a).

## Screening Analysis Based on Pathway 3

To calculate exposure from agricultural Pathway 3, the only pollutant-specific data required is the pollutant's concentration in sewage sludge, as described in Section 4.2.3. EPA chose to use 98th percentile pollutant concentrations with non-detects set equal to the minimum detection level. The Agency did not use 99th percentile concentrations because such estimates are not as statistically meaningful when pollutants are only detected a few percent of the time. For the non-pollutant-specific data required for this analysis, a sewage sludge ingestion rate of 0.2 g/day, a body weight of 16 kg, and an exposure duration (for cancer) of 5/70 were used.

To calculate risk, either an oral Risk Reference Dose (RfD) or an oral  $q_1^*$  value was needed. Of the 69 pollutants detected less than ten percent of the time, 49 had at least one of these estimates of toxicity. Six of these pollutants had already been evaluated for Pathway 3 in Round One, and so were not considered further: aldrin, dieldrin, benzo(a)pyrene, DDT, DDE, and trichloroethene. For the remaining 43 pollutants, EPA estimated risk. For those pollutants with an oral RfD value, the ratio of exposure to RfD was calculated. For those pollutants with an oral  $q_1^*$  value, the risk of cancer was estimated. These results are presented in Exhibit A-2.

As shown in Exhibit A-2, for all but one of the 43 pollutants analyzed, the ratio of exposure to RfD was below one and the cancer risk was below one in 100,000. For 2-picoline, the ratio of exposure to RfD was five. EPA chose to not evaluate 2-picoline further, however, because it was only detected one percent of the time in the 1988 NSSS.



# EXHIBIT A-1

## Available Human Toxicity Data for 72 Chemicals Detected Less Than 10 Percent of the Time<sup>a</sup>

CAS	Chemical Name	Percent Detect	REFERENCE DOSES		Mut. ?	CANCER POTENCY		WEIGHT OF EVIDENCE
			VALUES mg/kg - d <sup>b</sup> INHALATION	ORAL		VALUES Risk/mg/kg - d INHALATION	ORAL	
85687	BUTYL BENZYL PHTHALATE	9	ND	2.0E-01	N			C
740484	COBALT	9						
629970	DODOSANE, n-	8						
593453	OCTADECANE, n-	8						
205992	BENZO(B)FLUORANTHENE	7						
510156	CHLOROBENZILATE	7		2.0E-02	Y			
25155151	CYMENE, p-	7						
65850	BENZOIC ACID	6		4.0E+00	Y			D
319857	BHC, beta -	6						
95487	CRESOL, o -	6		5.0E-02	Y			C
72208	ENDRIN	6		3.0E-04	Y			D
206440	FLUORANTHENE	6		4.0E-02	Y			D
207089	BENZO(K)FLUORANTHENE	5						
106478	CHLOROANILINE, p-	5		4.0E-03	Y			
218019	CHRYSENE	5						
60571	DIELDRIN	5						
84742	DI-N-BUTYL PHTHALATE	5	ND	3.0E-05		1.60E+01	1.70E+01	B2
591786	HEXANONE, 2 -	5	1.4E-03 d	1.0E-01				
129000	PYRENE	5		3.0E-02	Y			D
75694	TRICHLOROFLUOROMETHANE	5	2.0E-01 e	3.0E-01	N			
56553	BENZ(A)ANTHRACENE	4						
100414	ETHYLBENZENE	4	2.9E-01	1.0E-01	Y			
1024573	HEPTACHLOR EPOXIDE	4		1.3E-05		9.1E+00	9.1E+00	B2
56235	TETRACHLOROMETHANE	4		7.0E-04		5.2E-02	1.3E-01	B2
1330207	XYLENE, m -	4		2.0E+00 e	N			D
309002	ALDRIN	3		3.0E-05		1.60E+01	1.70E+01	B2
50328	BENZO(A)PYRENE	3				6.10E+00	7.30E+00	B2
2921882	CHLORPYRIFOS	3		3.0E-03	Y			
78831	ISOBUTYL ALCOHOL	3		3.0E-01	Y			
1636755	NITROFEN (TOK)	3						
100425	STYRENE	3		2.0E-01				
127184	TETRACHLOROETHENE	3	ND	1.0E-02				
1582098	TRIFLURALIN (TREFLAN)	3		7.5E-03				
1330207	XYLENE, o - and p -	3	ND	2.0E+00	N	2.0E-03 e	3.0E-02 e	B2 e
98862	ACETOPHENONE	2		1.0E-01	Y	5.2E-07 e	5.1E-02 e	B2 e
120127	ANTHRACENE	2	5.7E-06 e	3.0E-01	Y		7.7E-03	C
86500	AZINPHOS METHYL	2	ND	7.5E-03 d	Y			D
319846	BHC, alpha -	2						
319868	BHC, delta -	2						
108907	CHLOROBENZENE	2	5.7E-03 e	2.0E-02	Y		1.7E+00 d	B2

# Available Human Toxicity Data for 72 Chemicals Detected Less Than 10 Percent of the Time<sup>a</sup> EXHIBIT A-1 (cont'd)

CAS	Chemical Name	Percent Detect	REFERENCE DOSES		Mut.? <sup>c</sup>	CANCER POTENCY	
			VALUES mg/kg - d <sup>b</sup> INHALATION	ORAL		VALUES Risk/mg/kg - d INHALATION	WEIGHT OF EVIDENCE INHAL ORAL
50293	DDT	2		5.00E-04		3.40E-01	
333415	DIAZINON	2		9.0E-04 e	Y	2.4E-02 e	C e
106467	DICHLOROBENZENE, 1,4 -	2	2.0E-01 e	7.0E-01 e			C e
1464535	DIEPOXYBUTANE, 1,2:3,4 -	2					
123911	DIOXANE, 1,4 -	2					
300765	NALED (DIBROM)	2		2.0E-03	Y	1.1E-02	B2
91203	NAPHTHALENE	2		4.0E-02 e	Y		
108101	PENTANONE, 4 - METHYL - 2 -	2	ND		Y		
85018	PHENANTHRENE	2	2.0E-02 e		N		
	PHOSPHORIC ACID, TRI - O - TOLYL ESTER	2					D
2104645	SANTOX (EPN)	2		1.0E-05 d			
98555	TERPINEOL, alpha -	2					
107493	TETRAETHYLPIROPHOSPHATE	2					
100516	BENZYL ALCOHOL	1		3.0E-01 e	Y		
92524	BIPHENYL	1	ND	5.0E-02	Y		
67663	CHLOROFORM	1	ND	1.0E-02		8.1E-02	B2
91587	CHLORONAPHTHALENE, 2 -	1		8.0E-02	N		
	DDE	1		5.00E-04		3.40E-01	
132649	DIBENZOFURAN	1					
540590	DICHLOROETHENE, trans - 1,2 -	1		2.0E-02	Y		D
60515	DIMETHOATE	1		2.0E-04	Y		
131113	DIMETHYL PHTHALATE	1		1.0E+01 e	Y		
117817	DI - N - OCTYL PHTHALATE	1	ND	2.0E-02			
959988	ENDOSULFAN - I	1		5.0E-05	N	1.4E-02	B2
91576	METHYLNAPHTHALENE, 2 -	1					
86306	N - NITROSODIPHENYLAMINE	1					
13171216	PHOSPHAMIDON	1					
109068	PICOLINE, 2 -	1		2.0E-04 d		4.9E-03	B2 e
79016	TRICHLOROETHENE	1		5.0E-04 d	Y	1.70E-02	
		1				1.10E-02	B2

<sup>a</sup> Toxicity data from IRIS (1992) unless otherwise noted.

<sup>b</sup> Inhalation Risk Reference Concentrations converted to units of (mg/kg - d) by assuming a person weighs 70 kg and breathes 20 m<sup>3</sup> air per day.

<sup>c</sup> Mutagenic activity as reported in RTECS (April 1993); Y = yes, N = no.

<sup>d</sup> Office of Pesticide Programs RfD Tracking Report (27 January 1992), and List of Chemicals Evaluated for Carcinogenic Potential (Health Effects Division, 27 February 1992).

<sup>e</sup> HEAST (data from 1992 and 1991 Tables were used, with 1992 data used preferentially over 1991 data.)

# EXHIBIT A-2 Agricultural Pathway 3 Analysis for 43 Chemicals with Oral RfD or q1\* Values

CAS	Chemical Name	98th Conc. ND = ML	Percent Detect	REFERENCE DOSES VALUES mg/kg - d <sup>b</sup>	CANCER POTENCY VALUES Risk/mg/kg - d	EXPOSURE (mg/kg - day)	EXP/RfD (fraction)	Individual Cancer Risk
85687	BUTYL BENZYL PHTHALATE	42801.58	9	ND	2.0E-01	5E-04	< 0.01	
510156	CHLOROBENZYLATE	110.58	7		2.0E-02	1E-06	< 0.01	
65850	BENZOIC ACID	263587.8	6		4.0E+00	3E-03	< 0.01	
95487	CRESOL, o -	271592.5	6		5.0E-02	3E-03	0.07	
72208	ENDRIN	84.95	6		3.0E-04	1E-06	< 0.01	
206440	FLUORANTHENE	42801.58	6		4.0E-02	5E-04	0.01	
106478	CHLOROANILINE, p -	42801.58	5		4.0E-03	5E-04	0.1	
84742	DI - N - BUTYL PHTHALATE	68172.03	5	ND	1.0E-01	9E-04	< 0.01	
129000	PYRENE	42801.58	5		3.0E-02	5E-04	0.02	
75694	TRICHLOROFLUOROMETHANE	5000.62	5	2.0E-01	3.0E-01	6E-05	< 0.01	
100414	ETHYLBENZENE	5012.94	4	2.9E-01	1.0E-01	6E-05	< 0.01	
1024573	HEPTACHLOR EPOXIDE	108.71	4		1.3E-05	1E-06	0.1	9E-07
56235	TETRACHLOROMETHANE	5000.62	4		7.0E-04	6E-05	0.09	6E-07
1330207	XYLENE, m -	5064.36	4		2.0E+00	6E-05	< 0.01	
2921882	CHLORPYRIFOS	343.87	3		3.0E-03	4E-06	< 0.01	
78831	ISOBUTYL ALCOHOL	5000.62	3		3.0E-01	6E-05	< 0.01	
100425	STYRENE	54538.92	3	ND	2.0E-01	7E-04	< 0.01	1E-06
127184	TRACHLOROETHENE	5000.62	3		1.0E-02	6E-05	< 0.01	2E-07
1582098	TRIFLURALIN (TRIFLAN)	271.62	3	ND	7.5E-03	3E-06	< 0.01	2E-09
1330207	XYLENE, o - and p -	5000.62	3		2.0E+00	6E-05	< 0.01	
98862	ACETOPHENONE	42801.58	2	5.7E-06	1.0E-01	5E-04	< 0.01	
120127	ANTHRACENE	42801.58	2	ND	3.0E-01	5E-04	< 0.01	
86500	AZINPHOS METHYL	645.97	2		7.5E-03	8E-06	< 0.01	
319868	BHC, delta -	136.65	2			2E-06		2E-07
108907	CHLOROBENZENE	5012.94	2	5.7E-03	2.0E-02	6E-05	< 0.01	
333415	DIAZINON	258.39	2		9.0E-04	3E-06	< 0.01	
106467	DICHLOROBENZENE, 1,4 -	42801.58	2	2.0E-01	7.0E-01	5E-04	< 0.01	9E-07
123911	DIOXANE, 1,4 -	5064.36	2			6E-05		5E-08
300765	NALED (DIBROM)	1756.88	2		2.0E-03	2E-05	0.01	
91203	NAPHTHALENE	42801.58	2	ND	4.0E-02	5E-04	0.01	
2104645	SANTOX (EPN)	258.81	2		1.0E-05	3E-06	0.3	
100516	BENZYL ALCOHOL	42809.81	1		3.0E-01	5E-04	< 0.01	
92524	BIPHENYL	43256.26	1	ND	5.0E-02	5E-04	0.01	
67663	CHLOROFORM	5052.05	1	ND	1.0E-02	6E-05	< 0.01	3E-08
91587	CHLORONAPHTHALENE, 2 -	42801.58	1		8.0E-02	5E-04	< 0.01	
540590	DICHLOROETHENE, trans -1,2 -	5052.05	1		2.0E-02	6E-05	< 0.01	
60515	DIMETHOATE	260.16	1		2.0E-04	3E-06	0.02	
131113	DIMETHYL PHTHALATE	42801.58	1	ND	1.0E+01	5E-04	< 0.01	
117817	DI - N - OCTYL PHTHALATE	42801.58	1		2.0E-02	5E-04	0.03	5E-07
959988	ENDOSULFAN - I	271.62	1		5.0E-05	3E-06	0.07	4E-07
86306	N - NITROSODIPHENYLAMINE	85603.17	1			1E-03		
13171216	PHOSPHAMIDON	1550.13	1			2E-05		
109068	PICOLINE, 2 -	214049.0	1		2.0E-04	3E-03	0.10	
					5.0E-04		5	

## Screening Analysis Based on Cancer Potency Slopes

The second screening analysis EPA conducted consisted of identifying those pollutants with relatively high cancer potency slopes. As shown in Exhibit A-1, four pollutants, aldrin, dieldrin, heptachlor epoxide, and benzo(a)pyrene, have relatively large  $q_1^*$  values. These pollutants were evaluated further.

Although aldrin and dieldrin are both insecticides, they are often evaluated together, as aldrin/dieldrin, because dieldrin is an environmental degradation product of aldrin. In addition, aldrin and dieldrin have the same human health toxicity values. In Round One, aldrin/dieldrin were evaluated for Pathways 1 through 11, but not 12, 13, or 14.

Given the  $\log(K_{ow})$  value for dieldrin is greater than five, aldrin/dieldrin might pose an unacceptable risk by sorbing to particles that subsequently erode and enter a stream. Aldrin/dieldrin is not expected to leach significantly to groundwater, given the high  $\log(K_{ow})$  value. However, aldrin/dieldrin might also pose an unacceptable risk through volatilization. Therefore, EPA evaluated risks from Pathway 12 and Pathway 13 for aldrin/dieldrin using the assumptions and equations presented in Sections 4.2.12 and 4.2.13, respectively.

To correspond to the methods used in the Comprehensive Hazard Identification exercise, the 95th percentile pollutant concentrations with the non-detect values set equal to the minimum detection level were used. The pollutant-specific data for both pathways are presented in Exhibit A-3.

**EXHIBIT A-3**  
**Pollutant-Specific Data Required for Pathways 12 and 13**

Parameter	Aldrin/Dieldrin
95th percentile concentration (mg/kg)	0.0486 <sup>1</sup>
$\log(K_{ow})$	5.48 <sup>2</sup>
$K_d$ (L/kg)	1173 <sup>3</sup>
Henry's Law constant (atm-m <sup>3</sup> /mol)	$1.1 \times 10^{-5}$ (2)
$K_{deg}$ (yr <sup>-1</sup> )	0 <sup>4</sup>
Diffusivity in Air (cm <sup>2</sup> /sec)	$4 \times 10^{-2}$ (3)
BCF (L/kg)	3400 <sup>3</sup>
FM (dimensionless)	10

<sup>1</sup> Composite aldrin/dieldrin concentration from 1988 NSSS.

<sup>2</sup> Schwarzenbach et al., 1993.

<sup>3</sup> Calculated using equations in Section 4.2.12.

<sup>4</sup> Howard, 1991.

Results of the analysis are presented in Exhibit A-4 for Pathway 12 and Exhibit A-5 for Pathway 13. For Pathway 12, the individual cancer risks range from  $7 \times 10^{-9}$  for reclamation sites to  $2 \times 10^{-8}$  for other land application sites. For Pathway 13, individual cancer risks range from  $9 \times 10^{-8}$  for agricultural land to  $1 \times 10^{-6}$  for reclamation sites.

**EXHIBIT A-4**  
**Individual Cancer Risks for Aldrin/Dieldrin from Pathway 12**

Agricultural Land	Forest	Reclamation Site	Public Contact Site
$2 \times 10^{-8}$	$2 \times 10^{-8}$	$7 \times 10^{-9}$	$2 \times 10^{-8}$

**EXHIBIT A-5**  
**Individual Cancer Risks for Aldrin/Dieldrin from Pathway 13**

Agricultural Land	Forest	Reclamation Site	Public Contact Site
$9 \times 10^{-8}$	$4 \times 10^{-7}$	$1 \times 10^{-6}$	$2 \times 10^{-7}$

For heptachlor epoxide, the individual risk for a child directly ingesting sewage sludge (Pathway 3) was calculated above to be  $9 \times 10^{-7}$  (Exhibit A-2). Given the low magnitude of the risk, this pollutant was not evaluated further.

Benzo(a)pyrene was fully evaluated for all land application pathways in Round One except Pathway 11 (tractor driver). Benzo(a)pyrene cannot be considered further in Round Two for Pathway 11, however, because there is not a Threshold Limit Value for this pollutant to be evaluated under Pathway 11.

**APPENDIX B**

**STATISTICAL ANALYSES**

**OF THE NATIONAL SEWAGE SLUDGE SURVEY DATA**

**Final Report:**  
**Percentile Estimates Used to Develop the List of Pollutants**  
**for Round Two of the Part 503 Regulation**

**Submitted to:**

**Environmental Protection Agency  
Office of Science and Technology  
Engineering and Analysis Division  
401 M Street, SW. (4303)  
Washington, DC 20460**

**Submitted by:**

**Health and Environment Studies and Systems Division  
Science Applications International Corporation  
1710 Goodridge Drive  
McLean, VA 22102**

**EPA Contract No. 68-C4-0046  
SAIC Project No. 01-0813-07-5046-010**



## I. INTRODUCTION

In February, 1993, the Environmental Protection Agency (EPA) promulgated limits for nine toxic pollutants in sewage sludge. These limits which were issued by EPA under the authority of section 405(d) Clean Water Act, as amended, are referred to as the "Round One" sewage sludge regulation. In May, 1993, the EPA submitted to the court a list of 31 candidate pollutants for "Round Two" regulations. This report presents percentile estimates used to develop the list of pollutants for Round Two of the Part 503 Regulation. All elements, compounds, or solids physically measured will be referred to in this report as pollutants. The term pollutant is used here to mean only that a substance, in certain quantities, could cause harm to human health or the environment; not that it will cause harm to human health or the environment.

Data analyzed to produce these pollutant concentration percentile estimates are from the EPA's 1988 National Sewage Sludge Survey (NSSS). Section II briefly describes the NSSS. Data conventions are presented in Section III. Section IV provides the statistical methodology employed to produce the percentile estimates. And finally, Section V presents tabulated percentile estimates.

## II. EPA's 1988 NATIONAL SEWAGE SLUDGE SURVEY

To support Round One and Two regulatory development efforts, the EPA's 1988 NSSS collected sewage sludge quality and pollutant occurrence data from a national probability sample of Publicly Owned Treatment Works (POTWs) practicing at least secondary treatment of wastewater. Operationally, secondary treatment was defined as a primary clarifier process followed by biological treatment and secondary clarification. In 1988, 11,407 POTWs in the 50 States, Puerto Rico, and the District of Columbia met this criteria.

A statistical probability sample of 208 POTWs in the contiguous states and the District of Columbia comprised the analytical component of the 1988 NSSS. These POTWs were randomly drawn from secondary or higher treatment POTWs which were categorized into one of four strata based on their average daily flow rate. These strata are defined as follows:

- 1) Flow greater than 100 million gallons per day (MGD)
- 2) Flow more than 10 MGD but less than or equal to 100 MGD
- 3) Flow more than 1 MGD but less than or equal to 10 MGD
- 4) Flow less than or equal to 1 MGD.

EPA contract personnel collected sewage sludge samples from 180 POTWs in the analytical component of the NSSS. Samples were collected just prior to use or disposal of the sewage sludge. All sample collection and preservation was conducted according to protocol. Contract laboratories analyzed each sewage sludge sample for 412 analytes. EPA adapted analytical methods 1624 and 1625 to allow volatile and semi-volatile organic analytes to be quantified from the sewage sludge matrix. Pesticides and polychlorinated biphenyls (PCBs) were quantified



according to EPA method 1618; method 1613 measured dibenzofurans and dioxins; metals, other inorganics, and classicals were quantified according to standard EPA methods. All chemical analysis methods were either developed, chosen, or adapted to allow for the most reliable and accurate measurement of the 412 analytes in the sewage sludge matrix.

A more detailed discussion the NSSS sampling plan, POTWs, and data is included in a November, 1992 final report entitled "Statistical Support Documentation for the 40 CFR, Part 503 Final Standards for the Use or Disposal of Sewage Sludge."

### III. DATA CONVENTIONS

A total of 208 POTWs were selected for sampling as part of the analytical component of the 1988 NSSS. However, 32 POTWs were excluded from the statistical analyses because sewage sludge samples were not obtained after the completion of secondary treatment of wastewater. POTWs that were selected for the NSSS but excluded from the statistical analyses are listed on Table 1. The EPISODE number listed on Table 1 designates the POTW's identification number in the analytical survey. An episode number of "0" indicates that the POTW was selected for sampling as part of the analytical probability sample but samples of sewage sludge were not collected.

The reported national pollutant concentration estimates were calculated from a sample of 176 POTWs. These estimates apply to a population of 7,750 POTWs that practiced at least secondary treatment of wastewater during 1988. Pesticides were not quantified for SurveyID 35-38-348 (Episode=1565.) Therefore, estimates for pesticides reported on the tables result from a sample of 175 POTWs and are projected to a population of 7,720 POTWs in the Nation. Sewage sludge samples from SurveyIDs 23-07-036 (Episode=1554) and 35-05-012 (Episode=1561) were not analyzed for the dioxin/furans. Therefore the dioxin estimates, generated from a sample of 174 POTWs, apply to a population of 7,714 POTWs. Adjusted stratum weights for each sample size are tabulated below.

ADJUSTED WEIGHTS for STRATA (w<sub>i</sub>) by Sample Size

STRATUM	Sample size = 174	Sample size = 175	Sample size = 176
1	27/7,714	27/7,720	27/7,750
2	301/7,714	307/7,720	307/7,750
3	1,838/7,714	1,838/7,720	1,868/7,750
4	5,548/7,714	5,548/7,720	5,548/7,750

In the NSSS, if a pollutant was measured above the Minimum Level, as adjusted for interferences, then the measure is considered a detection. In the August, 1989 document titled "Analytical Methods for the National Sewage Sludge Survey," the EPA's Industrial Technology Division defines a Minimum Level for pollutants quantified by gas chromatography combined with mass spectrometry (GCMS) as the level at which "the entire analytical system shall give recognizable mass spectra and acceptable calibration points." For elemental pollutants, the Minimum Level is defined as "the minimum concentration of substance that can be measured and reported in 99% confidence that the value is above zero." The final report for Round One Part 503 regulations refers to the Minimum Level as "roughly equivalent to the minimum concentration or amount of pollutant that could be measured."

If a pollutant was not measured above the Minimum Level, then estimates were generated using two substitution methods. One set of estimate were produced using the value of the Minimum Level for those samples for which the pollutant was considered to be a non-detect. The second set of estimates substituted zero for pollutant concentration value for those samples from which a pollutant was not quantified above the Minimum Level. Tabulated results identify the substitution method employed for the reported set of estimates.

Prior to calculating the estimates, pollutant concentrations were aggregated on a POTW basis to form one concentration value per POTW for each pollutant. Field duplicate samples were averaged together. For POTWs with multiple treatment trains, sample measurements on pollutant concentrations were averaged together, using a weighted average based on the dry weight of sewage sludge disposed by the treatment train associated with each sample. Primary samples were dropped from analysis. The quality of these primary sludges is different than that associated with secondary treatment. Because the percent solids in sampled sewage sludge ranged from less than one percent to 100 percent, reported pollutant concentrations were transformed to dry weight units as a function of the sample's percent solids. This transformation allows a standardized basis for evaluating pollutant loads. Implicit is the assumption that pollutants are associated with the solid phase of sewage sludge.

The dioxins and furans are reported individually and in aggregate. Aggregates were mathematically created using the following method. After each congener was aggregated on a POTW basis, the concentration of the congener for each POTW was multiplied by the congener's corresponding 1989 NATO Toxicity Equivalence Factor (TEF.) The TEF's which are based on the toxicity of 2,3,7,8 TCDD are listed in Table 2. The resulting TEF adjusted values were then summed over all congeners for each POTW to create the POTW composite dioxin concentration. Two conventions were used to determine if composite dioxin was a detect for a POTW. For the first convention, the composite dioxin was considered a detect if all of the individual congeners were detected above the Minimum Level. The estimate for this method is designated on the tables as "dioxin<sup>a</sup>." For the second method of determining a detection for the composite dioxin, the composite dioxin was considered a detect if at least one of the individual congeners was detected above the Minimum Level. This estimate is designated "dioxin<sup>b</sup>." TEF adjusted estimates of the individual congeners appear in Section V.

PCBs were also mathematically aggregated. These aggregates were generated as described above with the exception that the individual PCB's were not multiplied by a toxicity equivalence factor.

#### IV. STATISTICAL METHODS

Percentile estimates were calculated using the nonparametric, weighted cumulative distribution function (CDF) technique. Denote the dry weight concentration of a given pollutant in the sampled sewage sludge from the  $j^{\text{th}}$  POTW in the  $i^{\text{th}}$  survey flow stratum as  $X_{ij}$ . The values of the variable  $X_{ij}$  were then sorted in order of increasing concentration. The values of the adjusted survey weights ( $w_i$ ) associated with the ordered values of  $X$  are then summed until the first occurrence of  $p$ .

If  $X_p$  is defined as the concentration of the  $p^{\text{th}}$  percentile then,

$$X_p = F(X) \geq p \text{ where } F(X) = \sum_{i=1}^4 w_i F_i(X)$$

with

$$F_i = \sum_{j=1}^{n_{ij}} \frac{I(X_{ij} \leq x)}{n_{ij}}$$

$$\text{and } I(X_{ij} \leq x) = \begin{cases} 1 & \text{if } X_{ij} \leq x \text{ for } x \geq 0 \\ 0 & \text{otherwise.} \end{cases}$$

To determine the pollutant concentration associated with the  $p^{\text{th}}$  percentile, an inverse function was applied to the cumulative distribution function. Define the  $p^{\text{th}}$  percentile as  $F_X(x_p)$  such that  $P[X \leq x_p] \geq p/100$ . The inverse of this function  $F^{-1}(p)$ , is the smallest value of  $x$  satisfying  $F_X(x) \geq p$  where  $p$  is the desired percentile point ( $P$ ) divided by 100.

Because the cumulative distribution created by application of the formula in the previous section is empirical, integer valued percentile points are not always realized in the data. The convention applied to determine the concentration associated with the  $p^{\text{th}}$  integer percentile from the empirical distribution function was to determine the smallest concentration value  $x$  such that  $F_X(x) > p$ . This value was denoted  $x_{p+}$  and is the  $q^{\text{th}}$  ordered concentration. The next smallest concentration from  $x_{p+}$ , or the concentration associated with the  $(q-1)^{\text{st}}$  ordered concentration was then defined. The concentration value for the  $p^{\text{th}}$  percentile was obtained using linear interpolation between the  $q^{\text{th}}$  and  $(q-1)$  values.

Nonparametric estimates of pollutant concentration means and standard deviations are also reported in the tables. Retaining the definition of  $X_{ij}$  as the dry weight concentration of a given

pollutant in the sampled sewage sludge from the  $j^{\text{th}}$  POTW in the  $i^{\text{th}}$  survey stratum and  $w_i$  as the adjusted survey weight for the  $i^{\text{th}}$  stratum, then the mean pollutant concentration was estimated as listed on the next page.

$$E(X) = \sum_{i=1}^4 w_i \frac{\sum_{j=1}^{n_{ij}} X_{ij}}{n_{ij}}.$$

The pollutant concentration standard deviation was estimated as the square root of the method of moments estimator of the variance. That is:

$$V(X)^{1/2} = \left[ \sum_{i=1}^4 w_i \sum_{j=1}^{n_{ij}} \frac{X_{ij}^2}{n_{ij}} - [E(X)]^2 \right]^{1/2}.$$

## V. POLLUTANT CONCENTRATION PERCENTILE ESTIMATES

Tables 3 and 4 present pollutant concentration percentile estimates for pollutants from the 1988 National Sewage Sludge Survey (NSSS.) Taking into account the individual dioxin and furan congeners and the PCB aroclors, Tables 3 and 4 present concentration estimates for 353 pollutants. The listing of pollutants is ordered by percent detection. The ordering is from highest to lowest detection rates in the nation. Excluded from this listing are the metals regulated in Round One, and the 42 semiquantitative metals listed on Table 5. Of the 42 semiquantitative metals, 36 had no quantitative measurements recorded in the NSSS database. Of the remaining six, potassium and iodine had one recorded measure while silicon, strontium, and sulfur had measurements recorded for two samples. All other samples were missing measurements. This precluded estimation of pollutant concentrations. Estimates of phosphorus concentrations were generated from data collected using colorimetric method 365.2 as reported in EPA's August, 1989 "Analytical Method for the National Sewage Sludge Survey."

For each pollutant, the tables report the following: pollutant type, unit of measure, sample size, an estimate of the national percent detect, mean, standard deviation, the observed maximum, and the 99<sup>th</sup>, 98<sup>th</sup>, 95<sup>th</sup>, 90<sup>th</sup> and median percentiles estimated from empirical national, cumulative distributions of pollutant concentrations. The column labeled "Sample size" records the number of POTWs in the NSSS from which data were used to generate the reported estimates.

Table 3 is subtitled "Nonparametric Substitution Method Estimation Procedure - Nondetects Set to the Minimum Level." The nonparametric estimation procedure is that described in Section IV.

The substitution of nondetects set to Minimum Levels indicates that Minimum Level of a pollutant was used in the estimation procedure for those samples that were not quantified above the pollutant's Minimum Level of detection. Estimates on Table 4 were generated using the value zero for samples from which a pollutant was not quantified above the Minimum Level.

Tables 3 and 4 indicate that there are 45 tested pollutants detected at an estimated national rate of ten percent or higher from sewage sludge resulting from secondary or higher treatment of wastewater in 1988. EPA used this list of pollutants in conjunction with human health and ecological toxicity data to select the 31 candidate pollutants for Round Two regulation.

TABLE 1.

## LISTING OF POTWS EXCLUDED FROM PERCENTILE ESTIMATION

SURVEYID	EPISODE	REASON	FLOW STRATUM
12-49-455	0	Ineligible/Out of Business	1
21-25-234	0	Not sampled	2
25-38-345	0	Ineligible/Out of Business	2
25-50-472	1386	Only primary sludge sampled	2
31-18-140	1477	Data not entered into database	3
31-23-206	1398	Only primary sludge sampled	3
41-24-215	0	Not sampled	4
41-36-312	0	Not sampled	4
45-02-005	0	Wastewater Stabilization pond (WWSP)	4
45-11-064	0	WWSP	4
45-13-083	0	WWSP	4
45-13-089	0	WWSP	4
45-14-092	0	WWSP	4
45-15-112	0	WWSP	4
45-16-130	0	WWSP	4
45-17-131	0	WWSP	4
45-19-154	0	WWSP	4
45-23-208	0	WWSP	4
45-24-220	0	WWSP	4
45-25-229	0	Ineligible/Out of Business	4
45-25-231	0	WWSP	4
45-26-237	0	WWSP	4

45-28-246	0	WWSP	4
45-29-248	0	WWSP	4
45-30-253	0	WWSP	4
45-37-339	0	Not sampled	4
45-42-387	0	Ineligible/Out of Business	4
45-42-392	1488	Ineligible/Out of Business	4
45-45-415	0	WWSP	4
45-45-423	0	Not sampled	4
45-50-463	0	Not sampled	4
45-50-474	0	WWSP	4

TABLE 2  
1989 NATO TOXICITY EQUIVALENCY FACTORS

CONGENER	TEF
Octachlorodibenzo-p-dioxin	0.001
Octachlorodibenzofuran	0.001
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	0.010
1,2,3,4,6,7,8-Heptachlorodibenzofuran	0.010
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	0.100
1,2,3,4,7,8-Hexachlorodibenzofuran	0.100
1,2,3,4,7,8,9-Heptachlorodibenzofuran	0.010
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	0.100
1,2,3,6,7,8-Hexachlorodibenzofuran	0.100
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	0.500
1,2,3,7,8-Pentachlorodibenzofuran	0.050
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	0.100
1,2,3,7,8,9-Hexachlorodibenzofuran	0.100
2,3,4,6,7,8-Hexachlorodibenzofuran	0.100
2,3,4,7,8-Pentachlorodibenzofuran	0.500
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1.000
2,3,7,8,-Tetrachlorodibenzofuran	0.100



TABLE 3. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to the Minimum Level

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
CALCIUM	Metals	MG/KG	176	7750	100	35,300.00	46,500.00	333,000.00	313,000.00	151,000.00	84,600.00	68,600.00	28,200.00
IRON	Metals	MG/KG	176	7750	100	18,000.00	21,100.00	229,000.00	81,400.00	79,900.00	59,800.00	41,700.00	12,400.00
MAGNESIUM	Metals	MG/KG	176	7750	100	7,460.00	17,600.00	134,000.00	75,500.00	30,700.00	17,500.00	9,750.00	4,270.00
PHOSPHORUS	Metals	MG/KG	176	7750	100	4,580.00	9,870.00	71,700.00	42,600.00	17,600.00	13,400.00	12,100.00	1,330.00
SODIUM	Metals	MG/KG	176	7750	100	7,970.00	19,600.00	141,000.00	103,000.00	49,100.00	21,400.00	17,200.00	2,070.00
ALUMINUM	Metals	MG/KG	176	7750	100	11,200.00	14,800.00	92,700.00	85,300.00	70,200.00	36,400.00	19,400.00	7,550.00
BARIUM	Metals	MG/KG	176	7750	100	673.00	640.00	5,570.00	3,000.00	2,370.00	1,730.00	1,230.00	498.00
dioxins b	Dioxins	NG/KG	174	7714	100	80.40	172.00	1,820.00	556.00	532.00	311.00	218.00	50.40
MANGANESE	Metals	MG/KG	176	7750	100	538.00	1,040.00	13,200.00	4,080.00	3,720.00	1,620.00	828.00	278.00
OCTACHLORODIBENZO-P-DIOXIN	Dioxins	NG/KG	174	7714	100	11.70	59.20	905.00	127.00	116.00	33.70	15.80	3.32
TITANIUM	Metals	MG/KG	176	7750	98	109.00	140.00	2,380.00	570.00	416.00	363.00	237.00	60.50
1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN	Dioxins	NG/KG	174	7714	98	9.52	37.00	525.00	103.00	73.70	27.80	14.00	3.35
NITRATE	Classicals	MG/KG	176	7750	95	1,420.00	5,040.00	35,300.00	26,500.00	15,500.00	5,020.00	1,880.00	90.50
SILVER	Metals	MG/KG	176	7750	84	48.20	112.00	852.00	546.00	218.00	128.00	75.80	25.50
TIN	Metals	MG/KG	176	7750	84	108.00	278.00	2,100.00	1,370.00	715.00	138.00	130.00	51.80
NITRITE	Classicals	MG/KG	176	7750	83	201.00	1,210.00	17,700.00	2,820.00	2,810.00	462.00	215.00	12.80
OCTACHLORODIBENZOFURAN	Dioxins	NG/KG	174	7714	80	0.67	4.38	69.50	5.04	4.75	3.31	0.55	0.11
1,2,3,4,6,7,8-HEPTACHLORODIBENZOFURAN	Dioxins	NG/KG	174	7714	71	2.31	7.14	71.00	31.50	27.60	5.72	3.08	0.57
2,3,7,8-TETRACHLORODIBENZOFURAN	Dioxins	NG/KG	174	7714	65	2.50	3.32	33.70	14.80	14.70	7.89	4.70	1.70
FLUORIDE	Classicals	MG/KG	176	7750	63	128.00	233.00	1,510.00	1,280.00	1,040.00	411.00	319.00	44.20

(b) Composites considered a detect if at least one congener is measured above the minimum level.

\* Dioxins and Furans Reported as Toxic Equivalents

Note: Three significant figures are reported

TABLE 3. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to the Minimum Level

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
BIS(2-ETHYLHEXYL) PHTHALATE	Organics	UG/KG	176	7750	62	55,800.00	106,000.00	891,000.00	525,000.00	459,000.00	191,000.00	148,000.00	17,200.00
VANADIUM	Metals	MG/KG	176	7750	62	25.30	43.70	570.00	181.00	130.00	64.10	54.20	14.90
YTTRIUM	Metals	MG/KG	176	7750	61	6.62	5.77	52.50	21.40	21.00	20.00	14.10	5.20
TOLUENE	Organics	UG/KG	176	7750	61	41,300.00	118,000.00	1,180,000.00	575,000.00	439,000.00	238,000.00	93,400.00	1,680.00
2-PROPANONE	Organics	UG/KG	176	7750	58	64,300.00	323,000.00	2,430,000.00	1,460,000.00	738,000.00	116,000.00	65,200.00	4,710.00
1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN	Dioxins	NG/KG	174	7714	49	5.20	10.60	73.70	58.50	47.70	13.10	9.43	2.73
BORON	Metals	MG/KG	176	7750	48	34.10	65.30	310.00	304.00	293.00	182.00	68.70	13.20
P-CRESOL	Organics	UG/KG	176	7750	43	52,300.00	110,000.00	1,160,000.00	542,000.00	430,000.00	306,000.00	202,000.00	11,000.00
1,2,3,4,7,8-HEXACHLORODIBENZOFURAN	Dioxins	NG/KG	174	7714	43	7.08	20.80	150.00	108.00	73.20	15.40	11.00	2.80
METHYLENE CHLORIDE	Organics	UG/KG	176	7750	42	8,580.00	37,800.00	282,000.00	184,000.00	114,000.00	31,300.00	3,080.00	553.00
1,2,3,7,8-HEXACHLORODIBENZO-P-DIOXIN	Dioxins	NG/KG	174	7714	39	4.12	6.56	73.70	22.20	19.50	13.50	8.58	2.80
ANTIMONY	Metals	MG/KG	176	7750	38	6.47	20.00	880.00	27.30	25.50	24.00	13.80	3.20
CYANIDES (SOLUBLE SALTS AND COMPLEXES)	Classicals	MG/KG	176	7750	37	35.20	58.00	372.00	285.00	155.00	130.00	86.40	11.50
HEXANOIC ACID	Organics	UG/KG	176	7750	35	48,000.00	83,600.00	1,860,000.00	408,000.00	280,000.00	202,000.00	125,000.00	13,100.00
1,2,3,6,7,8-HEXACHLORODIBENZOFURAN	Dioxins	NG/KG	174	7714	35	3.43	5.84	73.70	18.90	15.00	11.70	7.71	1.80
2-BUTANONE	Organics	UG/KG	176	7750	34	25,500.00	98,900.00	1,540,000.00	553,000.00	544,000.00	69,300.00	38,400.00	2,550.00
PHENOL	Organics	UG/KG	176	7750	34	19,700.00	40,400.00	920,000.00	177,000.00	159,000.00	57,500.00	37,800.00	10,200.00
2,4,5-TRICHLOROPHENOXACETIC ACID	Pesticides	UG/KG	176	7750	29	21.00	134.00	2,170.00	73.80	67.10	50.50	28.30	6.88
2,3,4,6,7,8-HEXACHLORODIBENZOFURAN	Dioxins	NG/KG	174	7714	27	3.30	5.60	73.70	15.70	14.00	9.69	6.94	1.80
1,2,3,4,7,8-HEPTACHLORODIBENZOFURAN	Dioxins	NG/KG	174	7714	26	0.39	0.73	8.42	2.14	1.48	1.21	0.78	0.23

Note: Three significant figures are reported

TABLE 3. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to the Minimum Level

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
2,3,4,7,8-PENTACHLORODIBENZOFURAN	Dioxins	NG/KG	174	7714	26	11.30	27.40	368.00	74.50	68.00	46.50	37.90	5.22
1,2,3,4,7,8-HEXACHLORODIBENZO-P-DIOXIN	Dioxins	NG/KG	174	7714	25	3.73	6.07	73.70	19.00	19.00	13.60	7.87	2.25
BERYLLIUM	Metals	MG/KG	176	7750	22	1.84	2.43	21.00	8.58	8.33	6.00	5.00	0.86
1,2,3,7,8-PENTACHLORODIBENZOFURAN	Dioxins	NG/KG	174	7714	22	1.04	2.63	36.80	7.15	6.06	4.22	1.85	0.48
PCB b	Pesticides	UG/KG	175	7720	19	2,120.00	2,480.00	14,700.00	13,400.00	12,300.00	5,400.00	3,050.00	1,480.00
1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN	Dioxins	NG/KG	174	7714	18	8.97	25.70	368.00	68.70	60.10	39.00	16.30	4.92
ACETIC ACID (2,4-DICHLOROPHENOXY)	Pesticides	UG/KG	178	7750	18	10.40	17.60	422.00	68.40	65.60	30.00	19.00	6.06
1,2,3,7,8-HEXACHLORODIBENZOFURAN	Dioxins	NG/KG	174	7714	18	3.58	8.69	128.00	24.10	16.90	9.18	6.92	1.80
2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN	Dioxins	NG/KG	174	7714	18	10.80	12.80	116.00	42.30	33.60	26.70	24.00	6.88
N-HEXACOSANE	Organics	UG/KG	178	7750	15	11,800.00	32,800.00	498,000.00	58,800.00	43,300.00	33,300.00	28,800.00	4,760.00
N-TETRACOSANE	Organics	UG/KG	178	7750	15	14,900.00	44,200.00	650,000.00	101,000.00	87,200.00	42,800.00	31,200.00	5,260.00
2,4,5-TRICHLOROPHENOXYPROPIONIC ACID	Pesticides	UG/KG	178	7750	15	10.90	14.50	121.00	69.20	60.10	40.00	17.30	6.28
THALLIUM	Metals	MG/KG	178	7750	15	5.20	16.90	210.00	62.80	29.50	10.80	8.54	2.00
N-DODECANE	Organics	UG/KG	178	7750	14	19,800.00	42,800.00	525,000.00	221,000.00	201,000.00	88,700.00	35,800.00	5,870.00
N-TETRADECANE	Organics	UG/KG	178	7750	14	14,100.00	28,800.00	352,000.00	94,500.00	83,500.00	60,300.00	32,800.00	5,260.00
N-TRIACONTANE	Organics	UG/KG	178	7750	14	14,800.00	42,800.00	597,000.00	156,000.00	154,000.00	37,000.00	31,100.00	4,830.00
N-EICOSANE	Organics	UG/KG	176	7750	13	12,400.00	19,400.00	198,000.00	93,300.00	52,700.00	43,100.00	31,300.00	5,260.00
N-HEXADECANE	Organics	UG/KG	176	7750	12	14,800.00	50,000.00	758,000.00	121,000.00	48,800.00	33,900.00	31,200.00	5,260.00
N-OCTACOSANE	Organics	UG/KG	178	7750	12	12,800.00	28,800.00	413,000.00	68,100.00	43,400.00	33,300.00	31,800.00	5,260.00
ENDOSULFAN-II	Pesticides	UG/KG	175	7720	12	19.00	29.20	184.00	175.00	128.00	66.70	41.10	10.00

(b) Composites considered a defect if at least one PCB arador is measured above the minimum level.  
Note: Three significant figures are reported

TABLE 3. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to the Minimum Level

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
CARBON DISULFIDE	Organics	UG/KG	176	7750	10	1,080.00	3,260.00	31,800.00	19,200.00	5,400.00	3,130.00	2,080.00	408.00
PENTACHLORONITROBENZENE	Pesticides	UG/KG	175	7720	10	181.00	1,160.00	8,830.00	3,970.00	221.00	79.30	43.30	20.60
N-DECANE	Organics	UG/KG	176	7750	10	12,700.00	23,900.00	199,000.00	151,000.00	81,300.00	33,300.00	30,400.00	4,780.00
PCB-1260	Pesticides	UG/KG	175	7720	10	337.00	561.00	4,010.00	2,920.00	1,870.00	827.00	465.00	209.00
COBALT	Metals	MG/KG	176	7750	9	23.50	30.80	262.00	107.00	104.00	100.00	57.10	11.60
BUTYL BENZYL PHTHALATE	Organics	UG/KG	176	7750	9	8,860.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,780.00
PCB-1248	Pesticides	UG/KG	175	7720	9	275.00	311.00	5,200.00	1,660.00	1,500.00	873.00	428.00	209.00
N-DODECANE	Organics	UG/KG	176	7750	8	10,300.00	13,800.00	154,000.00	58,500.00	43,200.00	33,300.00	29,300.00	5,610.00
N-OCTADECANE	Organics	UG/KG	176	7750	8	11,300.00	16,500.00	154,000.00	93,100.00	51,800.00	33,300.00	30,300.00	5,280.00
PCB-1254	Pesticides	UG/KG	175	7720	8	501.00	1,260.00	9,350.00	5,490.00	2,520.00	1,570.00	828.00	209.00
CHLOROBENZILATE	Pesticides	UG/KG	175	7720	7	28.50	30.80	211.00	149.00	109.00	88.70	54.20	20.00
P-CYMENE	Organics	UG/KG	176	7750	7	10,900.00	14,600.00	154,000.00	88,100.00	43,200.00	33,800.00	30,800.00	5,280.00
BENZO(B)FLUORANTHENE	Organics	UG/KG	176	7750	8	9,830.00	13,500.00	154,000.00	46,700.00	43,000.00	33,000.00	28,000.00	4,780.00
BETA-BHC	Pesticides	UG/KG	175	7720	6	14.30	15.90	163.00	83.20	71.20	41.50	22.20	10.00
ENDRIN	Pesticides	UG/KG	175	7720	6	14.70	16.80	123.00	88.20	84.80	41.50	22.30	10.20
O-CRESOL	Organics	UG/KG	176	7750	6	16,500.00	48,300.00	329,000.00	327,000.00	257,000.00	42,800.00	28,300.00	4,780.00
FLUORANTHENE	Organics	UG/KG	176	7750	5	9,950.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,780.00
P-CHLOROANILINE	Organics	UG/KG	176	7750	5	9,940.00	13,800.00	154,000.00	46,700.00	43,000.00	33,300.00	28,800.00	4,780.00
PYRENE	Organics	UG/KG	176	7750	5	9,950.00	13,400.00	154,000.00	46,700.00	43,000.00	33,000.00	28,000.00	4,780.00
TRICHLOROFLUOROMETHANE	Organics	UG/KG	176	7750	5	1,000.00	2,940.00	31,800.00	7,210.00	5,110.00	3,470.00	2,080.00	357.00

TABLE 3. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to the Minimum Level

Pollutant	Type	Unit	Sample Size	POTWs	Percent Defect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
2-HEXANONE	Organics	UG/KG	176	7750	5	4,850.00	14,600.00	159,000.00	36,100.00	25,500.00	15,800.00	10,400.00	1,790.00
BENZO(A)ANTHRACENE	Organics	UG/KG	176	7750	4	9,760.00	13,400.00	154,000.00	46,700.00	43,000.00	33,000.00	28,000.00	4,760.00
BENZO(K)FLUORANTHENE	Organics	UG/KG	176	7750	4	9,790.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	28,000.00	4,760.00
BENZOIC ACID	Organics	UG/KG	176	7750	4	53,100.00	76,200.00	835,000.00	314,000.00	313,000.00	167,000.00	151,000.00	23,800.00
CHRYSENE	Organics	UG/KG	176	7750	4	9,750.00	13,400.00	154,000.00	46,700.00	43,000.00	33,100.00	28,000.00	4,760.00
DI-N-BUTYL PHTHALATE	Organics	UG/KG	176	7750	4	11,200.00	17,800.00	331,000.00	72,300.00	68,100.00	33,300.00	30,200.00	4,950.00
DIELDRIN	Pesticides	UG/KG	175	7720	4	13.40	13.70	105.00	74.20	53.60	33.30	20.80	10.20
ETHYLBENZENE	Organics	UG/KG	176	7750	4	995.00	2,930.00	31,800.00	7,280.00	5,120.00	3,130.00	2,080.00	370.00
HEPTACHLOR EPOXIDE	Pesticides	UG/KG	175	7720	4	25.50	26.70	211.00	149.00	107.00	45.70	38.10	18.70
M-XYLENE	Organics	UG/KG	178	7750	4	985.00	2,920.00	31,800.00	7,430.00	5,170.00	3,050.00	2,080.00	360.00
TETRACHLOROMETHANE	Organics	UG/KG	178	7750	4	989.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
ALDRIN	Pesticides	UG/KG	175	7720	3	13.00	13.40	105.00	74.20	53.60	25.20	20.80	10.00
BENZO(A)PYRENE	Organics	UG/KG	178	7750	3	8,740.00	13,400.00	154,000.00	48,700.00	43,000.00	32,900.00	27,700.00	4,760.00
CHLORPYRIFOS	Organics	UG/KG	176	7750	3	65.30	73.80	528.00	428.00	335.00	157.00	105.00	51.70
ISOBUTYL ALCOHOL	Pesticides	UG/KG	175	7720	3	987.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
NITROFEN (TOX)	Organics	UG/KG	176	7750	3	28.50	28.80	211.00	164.00	123.00	66.50	40.80	20.00
O-P XYLENE	Organics	UG/KG	176	7750	3	971.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
STYRENE	Organics	UG/KG	176	7750	3	12,100.00	24,000.00	310,000.00	67,300.00	63,800.00	37,300.00	30,400.00	4,760.00
TETRACHLOROETHENE	Organics	UG/KG	178	7750	3	984.00	2,930.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
TRIFLURALIN (TREFLAN)	Pesticides	UG/KG	175	7720	3	65.90	68.80	528.00	371.00	269.00	155.00	107.00	50.00

TABLE 3. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to the Minimum Level

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
AZINPHOS METHYL	Pesticides	UG/KG	176	7750	2	158.00	165.00	1,210.00	893.00	643.00	311.00	269.00	130.00
CHLOROBENZENE	Organics	UG/KG	176	7750	2	995.00	2,920.00	31,800.00	7,290.00	5,120.00	3,130.00	2,080.00	357.00
DELTA-BHC	Pesticides	UG/KG	175	7720	2	32.00	33.70	263.00	186.00	135.00	62.30	51.70	24.90
DIAZINON	Pesticides	UG/KG	176	7750	2	64.00	66.70	483.00	357.00	257.00	150.00	107.00	51.90
DIBENZOFURAN	Organics	UG/KG	176	7750	2	9,930.00	13,800.00	154,000.00	59,800.00	43,200.00	33,300.00	28,600.00	4,760.00
NALED (DIBROM)	Pesticides	UG/KG	176	7750	2	424.00	448.00	3,290.00	2,430.00	1,750.00	840.00	707.00	340.00
PHENANTHRENE	Organics	UG/KG	178	7750	2	9,930.00	13,500.00	154,000.00	46,700.00	43,000.00	33,300.00	28,800.00	4,760.00
PHOSPHORIC ACID, TRI-O-TOLYL ESTER	Pesticides	UG/KG	178	7750	2	742.00	978.00	7,080.00	5,180.00	3,640.00	1,530.00	1,310.00	570.00
SANTOX (EPN)	Pesticides	UG/KG	176	7750	2	62.60	68.10	545.00	359.00	258.00	124.00	104.00	51.90
TETRAETHYLPIROPHOSPHATE	Pesticides	UG/KG	176	7750	2	1,270.00	1,100.00	20,000.00	3,920.00	3,100.00	2,950.00	2,500.00	1,080.00
1,2,3,4-DIEPOXYBUTANE	Organics	UG/KG	176	7750	2	19,600.00	26,900.00	308,000.00	93,300.00	86,000.00	66,000.00	58,000.00	9,520.00
1,4-DICHLOROBENZENE	Organics	UG/KG	178	7750	2	9,720.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
1,4-DIOXANE	Organics	UG/KG	178	7750	2	987.00	2,860.00	36,000.00	7,540.00	5,170.00	3,130.00	2,080.00	357.00
4-METHYL-2-PENTANONE	Organics	UG/KG	176	7750	2	10,200.00	96,800.00	1,580,000.00	36,100.00	25,500.00	15,600.00	10,400.00	1,790.00
4,4'-DDT	Pesticides	UG/KG	175	7720	2	25.50	26.90	211.00	155.00	125.00	48.40	41.50	19.70
ACETOPHENONE	Organics	UG/KG	176	7750	2	9,720.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
ALPHA-BHC	Pesticides	UG/KG	175	7720	2	12.80	13.40	105.00	74.20	53.80	22.80	20.10	10.00
ALPHA-TERPNEOL	Organics	UG/KG	176	7750	2	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
ANTHRACENE	Organics	UG/KG	176	7750	2	9,740.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
BIPHENYL	Organics	UG/KG	176	7750	1	68,700.00	847,000.00	15,300,000.00	79,800.00	43,300.00	33,300.00	28,000.00	4,760.00

TABLE 3. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to the Minimum Level

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
CHLOROFORM	Organics	UG/KG	176	7750	1	986.00	2,950.00	31,800.00	7,530.00	5,160.00	3,130.00	2,080.00	357.00
DI-N-OCTYL PHTHALATE	Organics	UG/KG	176	7750	1	9,700.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
DIMETHOATE	Pesticides	UG/KG	176	7750	1	62.40	66.30	483.00	412.00	259.00	128.00	104.00	50.10
DIMETHYL PHTHALATE	Organics	UG/KG	176	7750	1	9,800.00	13,500.00	154,000.00	46,700.00	43,000.00	33,100.00	26,800.00	4,760.00
ENDOSULFAN-I	Pesticides	UG/KG	175	7720	1	63.30	67.00	528.00	371.00	269.00	115.00	95.90	49.20
N-NITROSODIPHENYLAMINE	Organics	UG/KG	176	7750	1	19,400.00	26,900.00	308,000.00	93,300.00	86,000.00	65,800.00	55,500.00	9,520.00
NAPHTHALENE	Organics	UG/KG	176	7750	1	9,690.00	13,500.00	154,000.00	46,700.00	43,000.00	32,900.00	28,000.00	4,760.00
TRANS-1,2-DICHLOROETHENE	Organics	UG/KG	176	7750	1	975.00	2,930.00	31,800.00	7,530.00	5,160.00	2,940.00	2,080.00	357.00
TRICHLOROETHENE	Organics	UG/KG	176	7750	1	978.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
2-CHLORONAPHTHALENE	Organics	UG/KG	176	7750	1	9,720.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
2-METHYLNAPHTHALENE	Organics	UG/KG	176	7750	1	10,100.00	15,500.00	154,000.00	66,100.00	43,200.00	33,300.00	28,600.00	4,760.00
2-PICOLINE	Organics	UG/KG	176	7750	1	48,900.00	67,400.00	769,000.00	236,000.00	215,000.00	165,000.00	139,000.00	23,800.00
4,4'-DDE	Pesticides	UG/KG	175	7720	1	63.80	67.10	528.00	371.00	269.00	124.00	99.10	49.30
ANILINE, 2,4,5-TRIMETHYL-	Organics	UG/KG	176	7750	0	19,400.00	27,000.00	308,000.00	100,000.00	86,100.00	66,000.00	56,000.00	9,520.00
ARAMITE	Organics	UG/KG	176	7750	0	48,400.00	67,200.00	769,000.00	233,000.00	215,000.00	164,000.00	139,000.00	23,800.00
AZINPHOS ETHYL	Pesticides	UG/KG	176	7750	0	155.00	165.00	1,210.00	893.00	643.00	308.00	260.00	125.00
BENZANTHRONE	Organics	UG/KG	176	7750	0	48,400.00	67,200.00	769,000.00	233,000.00	215,000.00	164,000.00	139,000.00	23,800.00
BENZENE	Organics	UG/KG	176	7750	0	966.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
BENZENETHIOL	Organics	UG/KG	176	7750	0	9,880.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
BENZIDINE	Organics	UG/KG	176	7750	0	48,400.00	67,200.00	769,000.00	233,000.00	215,000.00	164,000.00	139,000.00	23,800.00

TABLE 3. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to the Minimum Level

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
BENZO(GH)PERYLENE	Organics	UG/KG	176	7750	0	19,400.00	26,900.00	308,000.00	93,300.00	86,000.00	65,800.00	55,500.00	9,520.00
BENZONITRILE, 3,5-DIBROMO-4-HYDROXY-	Organics	UG/KG	176	7750	0	48,400.00	67,200.00	769,000.00	233,000.00	215,000.00	164,000.00	139,000.00	23,800.00
BENZYL ALCOHOL	Organics	UG/KG	176	7750	0	9,720.00	13,600.00	156,000.00	47,600.00	43,000.00	32,800.00	27,800.00	4,760.00
BETA-NAPHTHYLAMINE	Organics	UG/KG	176	7750	0	48,400.00	67,200.00	769,000.00	233,000.00	215,000.00	164,000.00	139,000.00	23,800.00
BIPHENYL, 4-NITRO	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,800.00	27,700.00	4,760.00
BIS(2-CHLOROETHOXY)METHANE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,800.00	27,700.00	4,760.00
BIS(2-CHLOROETHYL) ETHER	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,800.00	27,700.00	4,760.00
BIS(2-CHLOROISOPROPYL) ETHER	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,800.00	27,700.00	4,760.00
BROMODICHLOROMETHANE	Organics	UG/KG	176	7750	0	968.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
BROMOMETHANE	Organics	UG/KG	176	7750	0	4,830.00	14,600.00	159,000.00	36,100.00	25,500.00	15,800.00	10,400.00	1,790.00
CAPTAN	Pesticides	UG/KG	175	7720	0	632.00	670.00	5,260.00	3,710.00	2,680.00	1,140.00	951.00	492.00
CAPTAN	Pesticides	UG/KG	175	7720	0	127.00	134.00	1,050.00	747.00	541.00	228.00	184.00	96.50
CARBAZOLE	Organics	UG/KG	176	7750	0	19,400.00	26,900.00	308,000.00	93,300.00	86,000.00	65,800.00	55,500.00	9,520.00
CARBOPHENOTHION (TRITHION)	Pesticides	UG/KG	175	7720	0	632.00	670.00	5,260.00	3,710.00	2,680.00	1,140.00	951.00	492.00
CHLORDANE	Pesticides	UG/KG	175	7720	0	317.00	335.00	2,830.00	1,860.00	1,340.00	588.00	504.00	246.00
CHLOROACETONITRILE	Organics	UG/KG	176	7750	0	968.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
CHLOROETHANE	Organics	UG/KG	176	7750	0	4,830.00	14,600.00	159,000.00	36,100.00	25,500.00	15,800.00	10,400.00	1,790.00
CHLOROFENWPHOS	Pesticides	UG/KG	176	7750	0	62.10	65.80	483.00	357.00	257.00	124.00	104.00	50.00
CHLOROMETHANE	Organics	UG/KG	176	7750	0	4,830.00	14,600.00	159,000.00	36,100.00	25,500.00	15,800.00	10,400.00	1,790.00
CHODRN	Pesticides	UG/KG	175	7614	0	128.00	133.00	970.00	723.00	517.00	249.00	206.00	102.00



TABLE 3. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondefects Set to the Minimum Level

Pollutant	Type	Unit	Sample Size	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile	
CIS-1,3-DICHLOROPROPENE	Organics	UG/KG	176	7750	0	966.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
COUMAPHOS	Pesticides	UG/KG	176	7750	0	124.00	132.00	970.00	716.00	514.00	247.00	208.00	100.00
CROTONALDEHYDE	Organics	UG/KG	176	7750	0	4,830.00	14,600.00	159,000.00	36,100.00	25,500.00	15,600.00	10,400.00	1,790.00
CROTOXYPHOS	Organics	UG/KG	176	7750	0	95,800.00	133,000.00	1,520,000.00	462,000.00	426,000.00	326,000.00	275,000.00	47,100.00
DEMETON	Pesticides	UG/KG	176	7750	0	124.00	132.00	970.00	716.00	514.00	247.00	208.00	100.00
DI-N-PROPYLNITROSAMINE	Organics	UG/KG	176	7750	0	19,400.00	26,900.00	308,000.00	93,300.00	86,000.00	65,800.00	55,500.00	9,520.00
DIALATE	Pesticides	UG/KG	175	7720	0	128.00	135.00	1,050.00	743.00	537.00	251.00	199.00	98.40
DIBENZO(A,H)ANTHRACENE	Organics	UG/KG	176	7750	0	19,400.00	26,900.00	308,000.00	93,300.00	86,000.00	65,800.00	55,500.00	9,520.00
DIBENZOTHIOPHENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
DIBROMOCHLOROMETHANE	Organics	UG/KG	176	7750	0	968.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
DIBROMOMETHANE	Organics	UG/KG	176	7750	0	966.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
DICHLORVOS	Pesticides	UG/KG	176	7750	0	62.10	65.80	483.00	357.00	257.00	124.00	104.00	50.00
DICROTOPHOS (BIDRIN)	Pesticides	UG/KG	176	7750	0	358.00	380.00	2,780.00	2,060.00	1,480.00	712.00	598.00	289.00
DIETHYL ETHER	Organics	UG/KG	176	7750	0	4,880.00	14,600.00	159,000.00	36,100.00	25,500.00	15,600.00	10,400.00	1,790.00
DIETHYL PHTHALATE	Organics	UG/KG	176	7750	0	9,880.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
DIMETHYL SULFONE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
DIOXATHION	Pesticides	UG/KG	176	7750	0	497.00	528.00	3,870.00	2,860.00	2,080.00	988.00	831.00	400.00
DIPHENYL ETHER	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
DIPHENYLAMINE	Organics	UG/KG	176	7750	0	9,800.00	13,500.00	154,000.00	46,700.00	43,000.00	33,200.00	28,800.00	4,760.00
DIPHENYLDISULFIDE	Organics	UG/KG	176	7750	0	19,400.00	26,900.00	308,000.00	93,300.00	86,000.00	65,800.00	55,500.00	9,520.00

TABLE 3. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to the Minimum Level

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
DISULFOTON	Pesticides	UG/KG	176	7750	0	62.10	65.80	483.00	357.00	257.00	124.00	104.00	50.00
ENDOSULFAN SULFATE	Pesticides	UG/KG	175	7720	0	63.30	67.00	526.00	371.00	269.00	114.00	95.20	49.20
ENDRIN ALDEHYDE	Pesticides	UG/KG	175	7720	0	31.80	33.50	263.00	186.00	135.00	57.10	47.70	24.90
ENDRIN KETONE	Pesticides	UG/KG	175	7720	0	63.30	67.00	526.00	371.00	269.00	114.00	95.20	49.20
ETHANE, PENTACHLORO-	Organics	UG/KG	176	7750	0	19,400.00	26,900.00	308,000.00	93,300.00	86,000.00	65,800.00	55,500.00	9,520.00
ETHION	Pesticides	UG/KG	176	7750	0	62.10	65.80	483.00	357.00	257.00	124.00	104.00	50.00
ETHYL CYANIDE	Organics	UG/KG	176	7750	0	1,010.00	3,400.00	64,700.00	7,530.00	5,160.00	3,130.00	2,080.00	357.00
ETHYL METHACRYLATE	Organics	UG/KG	176	7750	0	966.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
ETHYL METHANESULFONATE	Organics	UG/KG	176	7750	0	19,400.00	26,900.00	308,000.00	93,300.00	86,000.00	65,800.00	55,500.00	9,520.00
ETHYLENETHIOUREA	Organics	UG/KG	176	7750	0	19,400.00	26,900.00	308,000.00	93,300.00	86,000.00	65,800.00	55,500.00	9,520.00
FAMPHUR	Pesticides	UG/KG	176	7750	0	62.10	65.80	483.00	357.00	257.00	124.00	104.00	50.00
FENSULFOTHION	Pesticides	UG/KG	176	7750	0	154.00	163.00	1,200.00	887.00	638.00	306.00	258.00	124.00
FENTHION	Pesticides	UG/KG	176	7750	0	62.10	65.80	483.00	357.00	257.00	124.00	104.00	50.00
FLUORENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
HEPTACHLOR	Pesticides	UG/KG	175	7720	0	25.30	28.80	211.00	149.00	107.00	45.70	36.10	19.70
HEXACHLOROBENZENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
HEXACHLOROBUTADIENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
HEXACHLOROCYCLOPENTADIENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
HEXACHLOROETHANE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
HEXACHLOROPROPENE	Organics	UG/KG	176	7750	0	19,400.00	26,900.00	308,000.00	93,300.00	86,000.00	65,800.00	55,500.00	9,520.00

**TABLE 3. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY**  
**Candidate Pollutants for Round Two Regulations**

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to the Minimum Level

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
INDENO(1,2,3-CD)PYRENE	Organics	UG/KG	176	7750	0	19,400.00	26,900.00	308,000.00	93,300.00	86,000.00	65,800.00	55,500.00	9,520.00
IODOMETHANE	Organics	UG/KG	176	7750	0	966.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
ISODRIN	Pesticides	UG/KG	175	7720	0	63.30	67.00	526.00	371.00	269.00	114.00	85.20	49.20
ISOPHORONE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
ISOSAFROLE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
LEPTOPHOS	Pesticides	UG/KG	176	7750	0	75.20	79.60	583.00	432.00	315.00	148.00	125.00	60.40
LINDANE (GAMMA-BHC)	Pesticides	UG/KG	175	7720	0	31.90	33.50	283.00	186.00	135.00	57.10	51.90	24.90
LONGIFOLENE	Organics	UG/KG	176	7750	0	48,400.00	67,200.00	769,000.00	233,000.00	215,000.00	164,000.00	139,000.00	23,800.00
MALACHITE GREEN	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
MALATHION	Pesticides	UG/KG	176	7750	0	62.10	65.80	483.00	357.00	257.00	124.00	104.00	50.00
MESTRANOL	Organics	UG/KG	176	7750	0	19,400.00	26,900.00	308,000.00	93,300.00	86,000.00	65,800.00	55,500.00	9,520.00
METHAPYRILENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
METHOXYCHLOR	Pesticides	UG/KG	175	7720	0	63.30	67.00	526.00	371.00	269.00	114.00	85.20	49.20
METHYL METHACRYLATE	Organics	UG/KG	176	7750	0	966.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
METHYL METHANESULFONATE	Organics	UG/KG	176	7750	0	19,400.00	26,900.00	308,000.00	93,300.00	86,000.00	65,800.00	55,500.00	9,520.00
METHYL PARATHION	Pesticides	UG/KG	176	7750	0	62.10	65.80	483.00	357.00	257.00	124.00	104.00	50.00
MEVINPHOS (PHOSDRIN)	Pesticides	UG/KG	176	7750	0	62.10	65.80	483.00	357.00	257.00	124.00	104.00	50.00
MIREX	Pesticides	UG/KG	175	7720	0	63.30	67.00	526.00	371.00	269.00	114.00	85.20	49.20
MONOCROTOPHOS	Pesticides	UG/KG	176	7750	0	1,880.00	1,980.00	14,500.00	10,700.00	7,710.00	3,700.00	3,120.00	1,500.00
N-NITROSODI-N-BUTYLAMINE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00

TABLE 3. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to the Minimum Level

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
N-NITROSODIETHYLAMINE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
N-NITROSODIMETHYLAMINE	Organics	UG/KG	176	7750	0	48,400.00	67,200.00	769,000.00	233,000.00	215,000.00	164,000.00	139,000.00	23,800.00
N-NITROSOMETHYLETHYLAMINE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
N-NITROSOMETHYLPHENYLAMINE	Organics	UG/KG	176	7750	0	95,800.00	133,000.00	1,520,000.00	462,000.00	426,000.00	326,000.00	275,000.00	47,100.00
N-NITROSOMORPHOLINE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
N-NITROSOPIPERIDINE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
N,N-DIMETHYLFORMAMIDE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
NITROBENZENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
O-ANISIDINE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
O-TOLUIDINE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
O-TOLUIDINE, 5-CHLORO-	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
P-DIMETHYLAMINOAZOBENZENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
P-NITROANILINE	Organics	UG/KG	176	7750	0	18,400.00	26,900.00	308,000.00	83,300.00	86,000.00	65,800.00	55,500.00	9,520.00
PARATHION	Pesticides	UG/KG	176	7750	0	48,400.00	67,200.00	769,000.00	233,000.00	215,000.00	164,000.00	139,000.00	23,800.00
PENTACHLOROBENZENE	Organics	UG/KG	176	7750	0	124.00	132.00	870.00	716.00	514.00	247.00	208.00	100.00
PENTACHLOROPHENOL	Organics	UG/KG	176	7750	0	18,400.00	26,900.00	308,000.00	83,300.00	86,000.00	65,800.00	55,500.00	9,520.00
PENTAMETHYLBENZENE	Organics	UG/KG	176	7750	0	48,400.00	67,200.00	769,000.00	233,000.00	215,000.00	164,000.00	139,000.00	23,800.00
PERYLENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
PHENACETIN	Organics	UG/KG	176	7750	0	9,720.00	13,500.00	154,000.00	50,400.00	43,000.00	33,000.00	28,000.00	4,760.00
PHENOL, 2-METHYL-4,6-DINITRO-	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
					0	19,400.00	26,900.00	308,000.00	83,300.00	86,000.00	65,800.00	55,500.00	9,520.00

TABLE 3. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondefects Set to the Minimum Level

Pollutant	Type		Sample Size	Percent Detect	Mean	Standard Deviation	Observed Maximum	Percentile Level					
	Unit	POTWs						99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile	
PHENOTHIAZINE	Organics	UG/KG	176	7750	0	48,400.00	67,200.00	769,000.00	233,000.00	215,000.00	164,000.00	139,000.00	23,800.00
PHORATE	Pesticides	UG/KG	176	7750	0	62.10	65.80	483.00	357.00	257.00	124.00	104.00	50.00
PHOSMET	Pesticides	UG/KG	176	7750	0	124.00	132.00	970.00	716.00	514.00	247.00	208.00	100.00
PHOSPHAMIDON	Pesticides	UG/KG	176	7750	0	373.00	396.00	2,900.00	2,150.00	1,540.00	741.00	623.00	300.00
PHOSPHORIC ACID, TRIMETHYL ESTER	Pesticides	UG/KG	176	7750	0	87.10	92.40	678.00	501.00	360.00	173.00	145.00	70.00
PHOSPHORIC TRIAMIDE, HEXAMETHYL-	Pesticides	UG/KG	176	7750	0	311.00	330.00	2,420.00	1,790.00	1,290.00	617.00	520.00	250.00
PRONAMIDE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
PYRIDINE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
RESORCINOL	Organics	UG/KG	176	7750	0	48,400.00	67,200.00	769,000.00	233,000.00	215,000.00	164,000.00	139,000.00	23,800.00
SAFROLE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
SQUALENE	Organics	UG/KG	176	7750	0	95,800.00	133,000.00	1,520,000.00	462,000.00	426,000.00	326,000.00	275,000.00	47,100.00
TERBUFOS	Pesticides	UG/KG	176	7750	0	62.10	65.80	483.00	357.00	257.00	124.00	104.00	50.00
TETRACHLORVINPHOS	Pesticides	UG/KG	176	7750	0	62.10	65.80	483.00	357.00	257.00	124.00	104.00	50.00
TETRAETHYLDITHIOPYROPHOSPHATE	Pesticides	UG/KG	176	7750	0	62.10	65.80	483.00	357.00	257.00	124.00	104.00	50.00
THIANAPHTHENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
THIOACETAMIDE	Organics	UG/KG	176	7750	0	19,400.00	26,900.00	308,000.00	93,300.00	86,000.00	65,800.00	55,500.00	9,520.00
THIOXANTHE-9-ONE	Organics	UG/KG	176	7750	0	19,400.00	26,900.00	308,000.00	93,300.00	86,000.00	65,800.00	55,500.00	9,520.00
TOLUENE, 2,4-DIAMINO-	Organics	UG/KG	176	7750	0	95,800.00	133,000.00	1,520,000.00	462,000.00	426,000.00	326,000.00	275,000.00	47,100.00
TOXAPHENE	Pesticides	UG/KG	175	7720	0	1,260.00	1,340.00	10,500.00	7,430.00	5,370.00	2,270.00	1,900.00	884.00
TRANS-1,3-DICHLOROPROPENE	Organics	UG/KG	176	7750	0	968.00	2,820.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00

TABLE 3. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to the Minimum Level

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
TRANS-1,4-DICHLORO-2-BUTENE	Organics	UG/KG	176	7750	0	4,880.00	14,600.00	159,000.00	36,100.00	25,500.00	15,600.00	10,400.00	1,790.00
TRIBROMOMETHANE	Organics	UG/KG	176	7750	0	966.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
TRICHLOROFON	Pesticides	UG/KG	176	7750	0	661.00	701.00	5,130.00	3,790.00	2,730.00	1,320.00	1,100.00	535.00
TRIPHENYLENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
TRIPROPYLENEGLYCOL METHYL ETHER	Organics	UG/KG	176	7750	0	95,800.00	133,000.00	1,520,000.00	462,000.00	426,000.00	326,000.00	275,000.00	47,100.00
VINYL ACETATE	Organics	UG/KG	176	7750	0	4,830.00	14,800.00	159,000.00	36,100.00	25,500.00	15,600.00	10,400.00	1,790.00
VINYL CHLORIDE	Organics	UG/KG	176	7750	0	966.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
1-BROMO-2-CHLOROBENZENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
1-BROMO-3-CHLOROBENZENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
1-CHLORO-3-NITROBENZENE	Organics	UG/KG	176	7750	0	48,400.00	67,200.00	769,000.00	233,000.00	215,000.00	164,000.00	139,000.00	23,800.00
1-METHYLFLUORENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
1-METHYLPHENANTHRENE	Organics	UG/KG	176	7750	0	9,730.00	13,500.00	154,000.00	46,700.00	43,000.00	33,300.00	28,800.00	4,760.00
1-NAPHTHYLAMINE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
1-PHENYLNAPHTHALENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
1,1-DICHLOROETHANE	Organics	UG/KG	176	7750	0	966.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
1,1,1-TRICHLOROETHANE	Organics	UG/KG	176	7750	0	966.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
1,1,1,2-TETRACHLOROETHANE	Organics	UG/KG	176	7750	0	1,030.00	3,210.00	31,800.00	16,000.00	5,200.00	3,130.00	2,060.00	357.00
1,1,2-TRICHLOROETHANE	Organics	UG/KG	176	7750	0	966.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,060.00	357.00
1,1,2,2-TETRACHLOROETHANE	Organics	UG/KG	176	7750	0	966.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,060.00	357.00

TABLE 3. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to the Minimum Level

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
1,2-DIBROMO-3-CHLOROPROPANE	Organics	UG/KG	176	7750	0	19,400.00	26,900.00	308,000.00	93,300.00	86,000.00	65,800.00	55,500.00	9,520.00
1,2-DIBROMOETHANE	Organics	UG/KG	176	7750	0	966.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
1,2-DICHLOROBENZENE	Organics	UG/KG	176	7750	0	9,700.00	13,500.00	154,000.00	47,600.00	43,000.00	32,900.00	27,800.00	4,760.00
1,2-DICHLOROETHANE	Organics	UG/KG	176	7750	0	966.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
1,2-DICHLOROPROPANE	Organics	UG/KG	176	7750	0	966.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
1,2-DIPHENYLHYDRAZINE	Organics	UG/KG	176	7750	0	19,400.00	26,900.00	308,000.00	93,300.00	86,000.00	65,800.00	55,500.00	9,520.00
1,2,3-TRICHLOROBENZENE	Organics	UG/KG	176	7750	0	9,680.00	13,500.00	154,000.00	46,700.00	43,400.00	32,800.00	27,800.00	4,760.00
1,2,3-TRICHLOROPROPANE	Organics	UG/KG	176	7750	0	966.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
1,2,3-TRIMETHOXYBENZENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,800.00	27,700.00	4,760.00
1,2,4-TRICHLOROBENZENE	Organics	UG/KG	176	7750	0	9,710.00	13,700.00	184,000.00	47,600.00	43,000.00	32,800.00	27,800.00	4,760.00
1,2,4,5-TETRACHLOROBENZENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,800.00	27,700.00	4,760.00
1,3-BUTADIENE, 2-CHLORO	Organics	UG/KG	176	7750	0	966.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
1,3-DICHLORO-2-PROPANOL	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,800.00	27,700.00	4,760.00
1,3-DICHLOROBENZENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,800.00	27,700.00	4,760.00
1,3-DICHLOROPROPANE	Organics	UG/KG	176	7750	0	966.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
1,3,5-TRITHIANE	Organics	UG/KG	176	7750	0	48,400.00	87,200.00	769,000.00	233,000.00	215,000.00	164,000.00	139,000.00	23,800.00
1,4-DINITROBENZENE	Organics	UG/KG	176	7750	0	19,400.00	26,900.00	308,000.00	93,300.00	86,000.00	65,800.00	55,500.00	9,520.00
1,4-NAPHTHOQUINONE	Organics	UG/KG	176	7750	0	95,800.00	133,000.00	1,520,000.00	462,000.00	428,000.00	328,000.00	275,000.00	47,100.00
1,4-NAPHTHOQUINONE, 2,3-DICHLORO-	Pesticides	UG/KG	175	7720	0	401.00	370.00	2,630.00	2,030.00	1,430.00	964.00	624.00	280.00
1,5-NAPHTHALENE DIAMINE	Organics	UG/KG	176	7750	0	95,800.00	133,000.00	1,520,000.00	462,000.00	428,000.00	328,000.00	275,000.00	47,100.00

TABLE 3. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to the Minimum Level

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
2-(METHYLTHIO)BENZOTHIAZOLE	Organics	UG/KG	176	7750	0	9,710.00	13,500.00	154,000.00	50,400.00	43,000.00	33,000.00	28,000.00	4,760.00
2-CHLOROETHYL VINYL ETHER	Organics	UG/KG	176	7750	0	966.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
2-CHLOROPHENOL	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
2-ISOPROPYLNAPHTHALENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
2-METHYLBENZOTHIAZOLE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
2-NITROANILINE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
2-NITROPHENOL	Organics	UG/KG	176	7750	0	19,400.00	26,900.00	308,000.00	93,300.00	86,000.00	65,800.00	55,500.00	9,520.00
2-PHENYLNAPHTHALENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
2-PROPEN-1-OL	Organics	UG/KG	176	7750	0	966.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
2-PROPENAL	Organics	UG/KG	176	7750	0	4,830.00	14,600.00	159,000.00	36,100.00	25,500.00	15,800.00	10,400.00	1,760.00
2-PROPENENITRILE, 2-METHYL-	Organics	UG/KG	176	7750	0	1,130.00	6,610.00	218,000.00	7,530.00	5,160.00	3,130.00	2,080.00	357.00
2,3-BENZOFLOURENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
2,3-DICHLOROANILINE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
2,3-DICHLORONITROBENZENE	Organics	UG/KG	176	7750	0	48,400.00	67,200.00	769,000.00	233,000.00	215,000.00	184,000.00	139,000.00	23,800.00
2,3,4,6-TETRACHLOROPHENOL	Organics	UG/KG	176	7750	0	19,400.00	26,900.00	308,000.00	93,300.00	86,000.00	65,800.00	55,500.00	9,520.00
2,3,6-TRICHLOROPHENOL	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
2,4-DICHLOROPHENOL	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
2,4-DIMETHYLPHENOL	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
2,4-DINITROPHENOL	Organics	UG/KG	176	7750	0	48,400.00	67,200.00	769,000.00	233,000.00	215,000.00	184,000.00	139,000.00	23,800.00
2,4-DINITROTOLUENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00



TABLE 3. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to the Minimum Level

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
2,4,5-TRICHLOROPHENOL	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
2,4,6-TRICHLOROPHENOL	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
2,6-DI-TERT-BUTYL-P-BENZOQUINONE	Organics	UG/KG	176	7750	0	95,800.00	133,000.00	1,520,000.00	462,000.00	426,000.00	326,000.00	275,000.00	47,100.00
2,6-DICHLORO-4-NITROANILINE	Organics	UG/KG	176	7750	0	95,800.00	133,000.00	1,520,000.00	462,000.00	426,000.00	326,000.00	275,000.00	47,100.00
2,6-DICHLOROPHENOL	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
2,6-DINITROTOLUENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
3-CHLOROPROPENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
3-METHYLCHOLANTHRENE	Organics	UG/KG	176	7750	0	967.00	2,920.00	31,800.00	7,210.00	5,110.00	3,130.00	2,080.00	357.00
3-NITROANILINE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
3,3'-DICHLOROBENZIDINE	Organics	UG/KG	176	7750	0	19,400.00	26,900.00	308,000.00	93,300.00	86,000.00	65,800.00	55,500.00	9,520.00
3,3'-DIMETHOXYBENZIDINE	Organics	UG/KG	176	7750	0	48,400.00	67,200.00	769,000.00	233,000.00	215,000.00	164,000.00	139,000.00	23,800.00
3,6-DIMETHYLPHENANTHRENE	Organics	UG/KG	176	7750	0	48,400.00	67,200.00	769,000.00	233,000.00	215,000.00	164,000.00	139,000.00	23,800.00
4-AMINOBIPHENYL	Organics	UG/KG	176	7750	0	9,750.00	13,500.00	154,000.00	46,700.00	43,000.00	33,300.00	28,800.00	4,760.00
4-BROMOPHENYL PHENYL ETHER	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
4-CHLORO-2-NITROANILINE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
4-CHLORO-3-METHYLPHENOL	Organics	UG/KG	176	7750	0	19,400.00	26,900.00	308,000.00	93,300.00	86,000.00	65,800.00	55,500.00	9,520.00
4-CHLOROPHENYLPHENYL ETHER	Organics	UG/KG	176	7750	0	9,780.00	13,900.00	154,000.00	50,400.00	43,000.00	33,000.00	28,000.00	4,760.00
4-NITROPHENOL	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
4,4'-DDD	Pesticides	UG/KG	175	7720	0	48,400.00	67,200.00	769,000.00	233,000.00	215,000.00	164,000.00	139,000.00	23,800.00
4,4'-METHYLENEBIS(2-CHLOROANILINE)	Organics	UG/KG	176	7750	0	63.30	67.10	526.00	419.00	394.00	114.00	95.30	49.20
						19,400.00	26,900.00	308,000.00	93,300.00	86,000.00	65,800.00	55,500.00	9,520.00

TABLE 3. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to the Minimum Level

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
4,5-METHYLENE PHENANTHRENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
5-NITRO-O-TOLUIDINE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
7,12-DIMETHYLBENZ(A)ANTHRACENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
ACENAPHTHENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
ACENAPHTHYLENE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
ACRYLONITRILE	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
ANILINE	Organics	UG/KG	176	7750	0	4,830.00	14,600.00	159,000.00	36,100.00	25,500.00	15,600.00	10,400.00	1,790.00
dioxins a	Organics	UG/KG	176	7750	0	9,680.00	13,400.00	154,000.00	46,700.00	43,000.00	32,900.00	27,700.00	4,760.00
PCB a	Dioxins	NG/KG	174	7714	0	90.40	172.00	1,820.00	556.00	532.00	311.00	218.00	50.40
PCB-1016	Pesticides	UG/KG	175	7720	0	2,120.00	2,480.00	14,700.00	13,400.00	12,300.00	5,400.00	3,050.00	1,480.00
PCB-1221	Pesticides	UG/KG	175	7720	0	253.00	268.00	2,110.00	1,490.00	1,070.00	454.00	381.00	197.00
PCB-1232	Pesticides	UG/KG	175	7720	0	253.00	268.00	2,110.00	1,490.00	1,070.00	454.00	381.00	197.00
PCB-1242	Pesticides	UG/KG	175	7720	0	253.00	268.00	2,110.00	1,490.00	1,070.00	454.00	381.00	197.00
	Pesticides	UG/KG	175	7720	0	253.00	268.00	2,110.00	1,490.00	1,070.00	454.00	381.00	197.00

(a) Composites considered a detect if all individual congeners or PCBs are measured above the minimum level.

TABLE 4. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to zero

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
CALCIUM	Metals	MG/KG	176	7750	100	35,300.00	46,500.00	333,000.00	313,000.00	151,000.00	84,600.00	66,600.00	26,200.00
IRON	Metals	MG/KG	176	7750	100	18,000.00	21,100.00	229,000.00	81,400.00	79,900.00	59,800.00	41,700.00	12,400.00
MAGNESIUM	Metals	MG/KG	176	7750	100	7,460.00	17,600.00	134,000.00	75,500.00	30,700.00	17,500.00	9,750.00	4,270.00
PHOSPHORUS	Metals	MG/KG	176	7750	100	4,580.00	9,870.00	71,700.00	42,600.00	17,600.00	13,400.00	12,100.00	1,330.00
SODIUM	Metals	MG/KG	176	7750	100	7,970.00	19,600.00	141,000.00	103,000.00	49,100.00	21,400.00	17,200.00	2,070.00
ALUMINIUM	Metals	MG/KG	176	7750	100	11,200.00	14,800.00	92,700.00	85,300.00	70,200.00	36,400.00	19,400.00	7,550.00
BARIUM	Metals	MG/KG	176	7750	100	673.00	640.00	5,570.00	3,000.00	2,370.00	1,730.00	1,230.00	499.00
dioxins b	Dioxins	NG/KG	174	7714	100	54.10	168.00	1,700.00	547.00	518.00	250.00	84.90	11.20
MANGANESE	Metals	MG/KG	176	7750	100	538.00	1,040.00	13,200.00	4,060.00	3,720.00	1,920.00	928.00	278.00
OCTACHLORODIBENZO-P-DIOXIN	Dioxins	NG/KG	174	7714	100	11.70	59.20	905.00	127.00	116.00	33.70	15.90	3.32
TITANIUM	Metals	MG/KG	176	7750	98	109.00	140.00	2,380.00	570.00	416.00	363.00	237.00	66.50
1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN	Dioxins	NG/KG	174	7714	98	9.50	37.00	525.00	103.00	73.70	27.90	14.00	3.35
NITRATE	Classicals	MG/KG	176	7750	95	1,420.00	5,040.00	35,300.00	26,500.00	15,500.00	5,020.00	1,880.00	98.50
SILVER	Metals	MG/KG	176	7750	84	46.40	113.00	652.00	546.00	218.00	128.00	75.80	23.70
TIN	Metals	MG/KG	176	7750	84	96.60	280.00	2,100.00	1,370.00	715.00	136.00	129.00	45.00
NITRITE	Classicals	MG/KG	176	7750	83	188.00	1,210.00	17,700.00	2,920.00	2,910.00	462.00	180.00	9.46
OCTACHLORODIBENZOFURAN	Dioxins	NG/KG	174	7714	80	0.65	4.38	69.50	5.04	4.75	3.31	0.55	0.06
1,2,3,4,6,7,8-HEPTACHLORODIBENZOFURAN	Dioxins	NG/KG	174	7714	71	1.70	6.46	71.00	31.50	27.60	5.11	2.93	0.36
2,3,7,8-TETRACHLORODIBENZOFURAN	Dioxins	NG/KG	174	7714	65	1.84	3.46	33.70	14.80	14.70	7.21	4.56	0.39
FLUORIDE	Classicals	MG/KG	176	7750	83	92.20	225.00	1,510.00	1,280.00	744.00	327.00	219.00	9.47

(b) Composites considered a detect if at least one congener is measured above the minimum level.

\* Dioxins and Furans Reported as Toxic Equivalents

Note: Three significant figures are reported

TABLE 4. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to zero

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
BIS(2-ETHYLHEXYL) PHTHALATE	Organics	UG/KG	176	7750	62	50,500.00	108,000.00	891,000.00	525,000.00	459,000.00	459,000.00	191,000.00	148,000.00
VANADIUM	Metals	MG/KG	176	7750	62	16.00	43.80	570.00	181.00	93.50	93.50	58.40	30.10
YTTRIUM	Metals	MG/KG	176	7750	61	3.02	3.51	16.20	14.30	13.50	13.50	8.97	6.80
TOLUENE	Organics	UG/KG	176	7750	61	40,800.00	118,000.00	1,180,000.00	575,000.00	439,000.00	439,000.00	238,000.00	93,400.00
2-PROPANONE	Organics	UG/KG	176	7750	58	58,400.00	323,000.00	2,430,000.00	1,460,000.00	738,000.00	738,000.00	74,900.00	39,700.00
1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN	Dioxins	NG/KG	174	7714	49	3.24	10.70	73.70	58.50	47.70	47.70	12.10	7.21
BORON	Metals	MG/KG	176	7750	48	28.10	66.90	310.00	304.00	293.00	293.00	182.00	84.40
P-CRESOL	Organics	UG/KG	176	7750	43	46,200.00	112,000.00	1,160,000.00	542,000.00	430,000.00	430,000.00	306,000.00	202,000.00
1,2,3,4,7,8-HEXACHLORODIBENZOFURAN	Dioxins	NG/KG	174	7714	43	5.05	21.20	150.00	109.00	73.20	73.20	15.30	8.17
METHYLENE CHLORIDE	Organics	UG/KG	176	7750	42	7,820.00	37,900.00	262,000.00	184,000.00	114,000.00	114,000.00	13,600.00	1,930.00
1,2,3,7,8-HEXACHLORODIBENZO-P-DIOXIN	Dioxins	NG/KG	174	7714	39	2.09	8.80	73.70	19.60	17.90	12.70	3.92	0.00
ANTIMONY	Metals	MG/KG	176	7750	38	1.90	19.10	680.00	20.50	9.88	4.55	3.20	0.00
CYANIDES (SOLUBLE SALTS AND COMPLEXES)	Classicals	MG/KG	176	7750	37	14.30	54.00	372.00	295.00	147.00	85.30	11.90	0.00
HEXANOIC ACID	Organics	UG/KG	176	7750	35	41,200.00	95,300.00	1,980,000.00	408,000.00	280,000.00	202,000.00	127,000.00	0.00
1,2,3,6,7,8-HEXACHLORODIBENZOFURAN	Dioxins	NG/KG	174	7714	35	1.20	5.55	73.70	15.00	15.00	9.00	0.80	0.00
2-BUTANONE	Organics	UG/KG	176	7750	34	18,300.00	98,400.00	1,540,000.00	541,000.00	510,000.00	43,300.00	5,510.00	0.00
PHENOL	Organics	UG/KG	176	7750	34	12,200.00	40,400.00	920,000.00	182,000.00	111,000.00	45,200.00	32,200.00	0.00
2,4,5-TRICHLOROPHENOXYACETIC ACID	Pesticides	UG/KG	176	7750	29	15.20	134.00	2,170.00	72.70	56.30	36.70	22.70	0.00
2,3,4,6,7,8-HEXACHLORODIBENZOFURAN	Dioxins	NG/KG	174	7714	27	1.05	5.22	73.70	14.80	13.10	3.43	1.19	0.00
1,2,3,4,7,8-HEPTACHLORODIBENZOFURAN	Dioxins	NG/KG	174	7714	26	0.16	0.72	8.42	1.54	1.45	1.11	0.20	0.00

Note: Three significant figures are reported

TABLE 4. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to zero

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
2,3,4,7,8-PENTACHLORODIBENZOFURAN	Dioxins	NG/KG	174	7714	26	6.27	27.50	368.00	74.50	68.00	45.50	5.33	0.00
1,2,3,4,7,8-HEXACHLORODIBENZO-P-DIOXIN	Dioxins	NG/KG	174	7714	25	1.48	5.91	73.70	17.90	16.20	13.40	2.29	0.00
BERYLLIUM	Metals	MG/KG	176	7750	22	0.14	0.36	3.90	1.17	0.96	0.70	0.50	0.00
1,2,3,7,8-PENTACHLORODIBENZOFURAN	Dioxins	NG/KG	174	7714	22	0.53	2.62	36.80	7.15	6.06	3.63	0.49	0.00
PCB b	Pesticides	UG/KG	175	7720	19	393.00	1,790.00	13,400.00	8,700.00	2,470.00	1,320.00	683.00	0.00
1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN	Dioxins	NG/KG	174	7714	18	4.56	25.50	368.00	66.70	60.10	27.50	3.33	0.00
ACETIC ACID (2,4-DICHLOROPHENOXY)	Pesticides	UG/KG	176	7750	16	3.62	16.50	422.00	42.00	30.90	23.70	11.30	0.00
1,2,3,7,8,9-HEXACHLORODIBENZOFURAN	Dioxins	NG/KG	174	7714	16	1.31	8.53	128.00	19.50	14.40	5.21	0.99	0.00
2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN	Dioxins	NG/KG	174	7714	18	1.71	8.45	116.00	26.30	25.00	7.59	2.43	0.00
N-HEXACOSANE	Organics	UG/KG	176	7750	15	2,920.00	31,200.00	498,000.00	44,200.00	19,300.00	3,270.00	868.00	0.00
N-TETRACOSANE	Organics	UG/KG	176	7750	15	6,620.00	43,800.00	650,000.00	97,700.00	84,100.00	24,400.00	3,930.00	0.00
2,4,5-TRICHLOROPHENOXYPROPIONIC ACID	Pesticides	UG/KG	178	7750	15	4.23	13.40	121.00	53.50	43.50	31.90	11.80	0.00
THALLIUM	Metals	MG/KG	176	7750	15	0.25	0.97	10.10	4.42	3.10	1.36	0.40	0.00
N-DODECANE	Organics	UG/KG	176	7750	14	12,000.00	43,200.00	525,000.00	221,000.00	198,000.00	83,000.00	20,000.00	0.00
N-TETRADECANE	Organics	UG/KG	176	7750	14	6,480.00	28,000.00	352,000.00	94,300.00	93,300.00	48,800.00	8,640.00	0.00
N-TRIACONTANE	Organics	UG/KG	176	7750	14	6,220.00	42,200.00	597,000.00	134,000.00	98,900.00	13,100.00	2,210.00	0.00
N-EICOSANE	Organics	UG/KG	176	7750	13	3,980.00	15,800.00	188,000.00	63,800.00	50,300.00	21,800.00	8,630.00	0.00
N-HEXADECANE	Organics	UG/KG	176	7750	12	6,130.00	48,600.00	758,000.00	110,000.00	35,700.00	20,200.00	166.00	0.00
N-OCTACOSANE	Organics	UG/KG	176	7750	12	3,760.00	27,300.00	413,000.00	45,300.00	32,500.00	21,500.00	1,620.00	0.00
ENDOSULFAN-H	Pesticides	UG/KG	175	7720	12	7.79	29.00	184.00	175.00	128.00	44.80	12.50	0.00

(b) Composites considered a detect if at least one PCB archlor is measured above the minimum level.

Note: Three significant figures are reported

TABLE 4. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to zero

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
CARBON DISULFIDE	Organics	UG/KG	176	7750	10	127.00	1,520.00	23,500.00	496.00	413.00	76.80	10.20	0.00
PENTACHLORONITROBENZENE	Pesticides	UG/KG	175	7720	10	158.00	1,160.00	8,830.00	3,970.00	156.00	20.20	0.15	0.00
N-DECANE	Organics	UG/KG	176	7750	10	4,180.00	22,400.00	199,000.00	149,000.00	67,800.00	15,800.00	0.00	0.00
PCB-1260	Pesticides	UG/KG	175	7720	10	97.20	534.00	4,010.00	2,190.00	650.00	494.00	0.00	0.00
COBALT	Metals	MG/KG	176	7750	9	1.15	7.03	103.00	17.00	13.90	6.30	0.00	0.00
BUTYL BENZYL PHTHALATE	Organics	UG/KG	176	7750	9	475.00	2,010.00	13,400.00	10,100.00	6,610.00	2,720.00	0.00	0.00
PCB-1248	Pesticides	UG/KG	175	7720	9	33.60	193.00	5,200.00	600.00	376.00	231.00	0.00	0.00
N-DODECANE	Organics	UG/KG	176	7750	8	907.00	5,010.00	70,200.00	24,300.00	7,220.00	5,770.00	0.00	0.00
N-OCTADECANE	Organics	UG/KG	176	7750	8	2,270.00	11,800.00	130,000.00	58,400.00	33,400.00	13,600.00	0.00	0.00
PCB-1254	Pesticides	UG/KG	175	7720	8	262.00	1,280.00	9,350.00	5,480.00	2,430.00	1,240.00	0.00	0.00
CHLOROBENZILATE	Pesticides	UG/KG	175	7720	7	5.48	21.50	104.00	101.00	97.70	54.50	0.00	0.00
P-CYMENE	Organics	UG/KG	176	7750	7	1,380.00	7,410.00	84,300.00	35,100.00	33,300.00	4,880.00	0.00	0.00
BENZO(B)FLUORANTHENE	Organics	UG/KG	178	7750	8	181.00	1,750.00	34,200.00	1,330.00	1,180.00	232.00	0.00	0.00
BETA-BHC	Pesticides	UG/KG	175	7720	8	2.30	11.10	163.00	51.50	38.80	22.80	0.00	0.00
ENDRIN	Pesticides	UG/KG	175	7720	8	2.85	12.80	123.00	62.70	42.00	11.70	0.00	0.00
O-CRESOL	Organics	UG/KG	176	7750	6	7,500.00	47,800.00	329,000.00	327,000.00	257,000.00	486.00	0.00	0.00
FLUORANTHENE	Organics	UG/KG	178	7750	5	331.00	1,870.00	19,400.00	11,500.00	8,200.00	140.00	0.00	0.00
P-CHLOROANILINE	Organics	UG/KG	178	7750	5	397.00	2,930.00	40,200.00	5,880.00	4,140.00	257.00	0.00	0.00
PYRENE	Organics	UG/KG	178	7750	5	320.00	2,000.00	37,100.00	8,550.00	5,600.00	345.00	0.00	0.00
TRICHLOROFLUOROMETHANE	Organics	UG/KG	176	7750	5	71.50	520.00	3,970.00	1,600.00	116.00	4.88	0.00	0.00

TABLE 4. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to zero

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
2-HEXANONE	Organics	UG/KG	176	7750	5	28.60	344.00	12,700.00	468.00	441.00	0.00	0.00	0.00
BENZO(A)ANTHRACENE	Organics	UG/KG	176	7750	4	104.00	1,250.00	40,500.00	1,160.00	998.00	0.00	0.00	0.00
BENZO(K)FLUORANTHENE	Organics	UG/KG	176	7750	4	136.00	1,310.00	31,200.00	1,390.00	1,060.00	0.00	0.00	0.00
BENZOIC ACID	Organics	UG/KG	176	7750	4	6,620.00	43,100.00	835,000.00	227,000.00	48,900.00	0.00	0.00	0.00
CHRYSENE	Organics	UG/KG	176	7750	4	102.00	1,110.00	32,400.00	1,130.00	1,090.00	0.00	0.00	0.00
DI-N-BUTYL PHTHALATE	Organics	UG/KG	176	7750	4	1,690.00	13,100.00	322,000.00	56,300.00	11,800.00	0.00	0.00	0.00
DIELDRIN	Pesticides	UG/KG	175	7720	4	1.05	5.54	47.50	29.50	23.40	0.00	0.00	0.00
ETHYLBENZENE	Organics	UG/KG	176	7750	4	24.80	321.00	20,200.00	520.00	322.00	0.00	0.00	0.00
HEPTACHLOR EPOXIDE	Pesticides	UG/KG	175	7720	4	0.60	3.14	17.90	18.90	13.80	0.00	0.00	0.00
M-XYLENE	Organics	UG/KG	176	7750	4	27.00	254.00	6,910.00	468.00	372.00	0.00	0.00	0.00
TETRACHLOROMETHANE	Organics	UG/KG	176	7750	4	4.05	28.10	339.00	90.80	67.90	0.00	0.00	0.00
ALDRIN	Pesticides	UG/KG	175	7720	3	0.84	3.70	38.80	19.40	13.70	0.00	0.00	0.00
BENZO(A)PYRENE	Organics	UG/KG	176	7750	3	78.80	1,140.00	24,700.00	988.00	749.00	0.00	0.00	0.00
CHLORPYRIFOS	Pesticides	UG/KG	176	7750	3	4.77	39.40	529.00	79.40	64.60	0.00	0.00	0.00
ISOBUTYL ALCOHOL	Organics	UG/KG	176	7750	3	0.94	10.80	165.00	6.37	2.44	0.00	0.00	0.00
NTROFEN (TOX)	Pesticides	UG/KG	175	7720	3	1.59	13.30	195.00	28.80	22.50	0.00	0.00	0.00
O-P XYLENE	Organics	UG/KG	176	7750	3	8.30	101.00	2,740.00	155.00	86.20	0.00	0.00	0.00
STYRENE	Organics	UG/KG	176	7750	3	2,490.00	21,000.00	310,000.00	51,200.00	28,200.00	0.00	0.00	0.00
TETRACHLOROETHENE	Organics	UG/KG	176	7750	3	40.50	300.00	4,050.00	1,270.00	526.00	0.00	0.00	0.00
TRIFLURALIN (TREFLAN)	Pesticides	UG/KG	175	7720	3	3.78	24.90	235.00	117.00	58.50	0.00	0.00	0.00

TABLE 4. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to zero

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
AZINPHOS METHYL	Pesticides	UG/KG	176	7750	2	4.91	36.10	279.00	127.00	0.00	0.00	0.00	0.00
CHLOROBENZENE	Organics	UG/KG	176	7750	2	31.20	263.00	8,920.00	1,420.00	196.00	0.00	0.00	0.00
DELTA-BHC	Pesticides	UG/KG	175	7720	2	1.28	8.88	81.80	56.80	21.00	0.00	0.00	0.00
DIAZINON	Pesticides	UG/KG	176	7750	2	2.63	19.70	151.00	64.30	0.00	0.00	0.00	0.00
DIBENZOFURAN	Organics	UG/KG	176	7750	2	275.00	3,690.00	59,300.00	3,940.00	0.00	0.00	0.00	0.00
NALED (DIBROM)	Pesticides	UG/KG	176	7750	2	7.16	47.30	484.00	299.00	207.00	0.00	0.00	0.00
PHENANTHRENE	Organics	UG/KG	176	7750	2	348.00	2,860.00	40,200.00	7,370.00	2,850.00	0.00	0.00	0.00
PHOSPHORIC ACID, TRI-O-TOLYL ESTER	Pesticides	UG/KG	176	7750	2	127.00	930.00	7,080.00	4,380.00	442.00	0.00	0.00	0.00
SANTOX (EPN)	Pesticides	UG/KG	176	7750	2	1.22	11.20	545.00	28.20	0.00	0.00	0.00	0.00
TETRAETHYLPYROPHOSPHATE	Pesticides	UG/KG	176	7750	2	53.80	622.00	20,000.00	1,720.00	0.00	0.00	0.00	0.00
1,2,3,4-DIEPOXYBUTANE	Organics	UG/KG	176	7750	2	229.00	2,720.00	73,900.00	2,180.00	0.00	0.00	0.00	0.00
1,4-DICHLOROBENZENE	Organics	UG/KG	176	7750	2	88.90	684.00	12,000.00	3,070.00	647.00	0.00	0.00	0.00
1,4-DIOXANE	Organics	UG/KG	176	7750	2	13.90	518.00	35,300.00	52.30	0.00	0.00	0.00	0.00
4-METHYL-2-PENTANONE	Organics	UG/KG	176	7750	2	2.68	27.00	587.00	32.20	9.65	0.00	0.00	0.00
4,4'-DDT	Pesticides	UG/KG	175	7720	2	0.51	4.42	121.00	13.30	8.35	0.00	0.00	0.00
ACETOPHENONE	Organics	UG/KG	176	7750	2	125.00	908.00	6,920.00	3,530.00	337.00	0.00	0.00	0.00
ALPHA-BHC	Pesticides	UG/KG	175	7720	2	0.27	1.93	46.90	11.70	3.45	0.00	0.00	0.00
ALPHA-TERPINEOL	Organics	UG/KG	176	7750	2	18.90	150.00	2,560.00	501.00	0.00	0.00	0.00	0.00
ANTHRACENE	Organics	UG/KG	176	7750	2	87.20	894.00	27,200.00	1,800.00	0.00	0.00	0.00	0.00
BI-PHENYL	Organics	UG/KG	176	7750	1	59,000.00	947,000.00	15,300,000.00	5,640.00	0.00	0.00	0.00	0.00



TABLE 4. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to zero

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
CHLOROFORM	Organics	UG/KG	176	7750	1	20.40	454.00	15,900.00	0.00	0.00	0.00	0.00	0.00
DI-N-OCTYL PHTHALATE	Organics	UG/KG	176	7750	1	31.70	588.00	18,300.00	0.00	0.00	0.00	0.00	0.00
DIMETHOATE	Pesticides	UG/KG	176	7750	1	0.61	10.50	340.00	0.00	0.00	0.00	0.00	0.00
DIMETHYL PHTHALATE	Organics	UG/KG	176	7750	1	135.00	2,010.00	32,400.00	0.00	0.00	0.00	0.00	0.00
ENDOSULFAN-I	Pesticides	UG/KG	175	7720	1	0.29	4.21	125.00	1.93	0.00	0.00	0.00	0.00
N-NITROSODIPHENYLAMINE	Organics	UG/KG	176	7750	1	101.00	1,290.00	19,700.00	0.00	0.00	0.00	0.00	0.00
NAPHTHALENE	Organics	UG/KG	176	7750	1	104.00	1,420.00	28,700.00	316.00	0.00	0.00	0.00	0.00
TRANS-1,2-DICHLOROETHENE	Organics	UG/KG	176	7750	1	12.50	303.00	10,700.00	0.00	0.00	0.00	0.00	0.00
TRICHLOROETHENE	Organics	UG/KG	176	7750	1	18.50	220.00	3,300.00	45.40	0.00	0.00	0.00	0.00
2-CHLORONAPHTHALENE	Organics	UG/KG	176	7750	1	54.80	714.00	11,100.00	0.00	0.00	0.00	0.00	0.00
2-METHYLNAPHTHALENE	Organics	UG/KG	176	7750	1	533.00	8,380.00	136,000.00	0.00	0.00	0.00	0.00	0.00
2-PCOLINE	Organics	UG/KG	176	7750	1	555.00	7,300.00	365,000.00	0.00	0.00	0.00	0.00	0.00
4,4'-DDE	Pesticides	UG/KG	175	7720	1	0.72	9.46	190.00	0.00	0.00	0.00	0.00	0.00
ANILINE, 2,4,5-TRIMETHYL-	Organics	UG/KG	178	7750	0	71.40	2,610.00	85,500.00	0.00	0.00	0.00	0.00	0.00
ARAMITE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AZINPHOS ETHYL	Pesticides	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BENZANTHRONE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BENZENE	Organics	UG/KG	176	7750	0	0.07	3.50	220.00	0.00	0.00	0.00	0.00	0.00
BENZENETHIOL	Organics	UG/KG	176	7750	0	2.43	88.70	3,250.00	0.00	0.00	0.00	0.00	0.00
BENZIDINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 4. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to zero

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
BENZO(GH)PERYLENE	Organics	UG/KG	176	7750	0	13.80	383.00	12,900.00	0.00	0.00	0.00	0.00	0.00
BENZONITRILE, 3,5-DIBROMO-4-HYDROXY-	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BENZYL ALCOHOL	Organics	UG/KG	176	7750	0	82.50	2,270.00	156,000.00	0.00	0.00	0.00	0.00	0.00
BETA-NAPHTHYLAMINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BIPHENYL, 4-NITRO	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BIS(2-CHLOROETHOXY)METHANE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BIS(2-CHLOROETHYL) ETHER	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BIS(2-CHLOROISOPROPYL) ETHER	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BROMODICHLOROMETHANE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BROMOMETHANE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAPTAFOL	Pesticides	UG/KG	175	7720	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAPTAN	Pesticides	UG/KG	175	7720	0	0.88	17.30	888.00	0.00	0.00	0.00	0.00	0.00
CARBAZOLE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CARBOPHENOTHION (TRITHION)	Pesticides	UG/KG	175	7720	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHLORDANE	Pesticides	UG/KG	175	7720	0	1.88	30.20	489.00	0.00	0.00	0.00	0.00	0.00
CHLOROACETONITRILE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHLOROETHANE	Organics	UG/KG	176	7750	0	0.08	2.05	75.10	0.00	0.00	0.00	0.00	0.00
CHLOROFENVINPHOS	Pesticides	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHLOROMETHANE	Organics	UG/KG	176	7750	0	0.07	2.67	87.80	0.00	0.00	0.00	0.00	0.00
CHODRIN	Pesticides	UG/KG	175	7614	0	0.35	5.71	93.00	0.00	0.00	0.00	0.00	0.00

TABLE 4. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to zero

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
CIS-1,3-DICHLOROPROPENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
COUMAPHOS	Pesticides	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CROTONALDEHYDE	Organics	UG/KG	176	7750	0	0.27	9.78	358.00	0.00	0.00	0.00	0.00	0.00
CROTOXYPHOS	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DEMETON	Pesticides	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DI-N-PROPYLNITROSAMINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIALLATE	Pesticides	UG/KG	175	7720	0	1.69	25.20	394.00	0.00	0.00	0.00	0.00	0.00
DIBENZO(A,H)ANTHRACENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIBENZOTHIOPHENE	Organics	UG/KG	176	7750	0	1.10	40.20	1,470.00	0.00	0.00	0.00	0.00	0.00
DIBROMOCHLOROMETHANE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIBROMOMETHANE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DICHLORVOS	Pesticides	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DICROTOPHOS (BIDRIN)	Pesticides	UG/KG	176	7750	0	0.41	15.00	550.00	0.00	0.00	0.00	0.00	0.00
DIETHYL ETHER	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIETHYL PHTHALATE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DMETHYL SULFONE	Organics	UG/KG	176	7750	0	3.00	48.40	784.00	0.00	0.00	0.00	0.00	0.00
DOXATHION	Pesticides	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIPHENYL ETHER	Organics	UG/KG	176	7750	0	3.88	234.00	18,400.00	0.00	0.00	0.00	0.00	0.00
DIPHENYLAMINE	Organics	UG/KG	176	7750	0	125.00	2,010.00	32,800.00	0.00	0.00	0.00	0.00	0.00
DIPHENYLDISULFIDE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 4. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to zero

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
DISULFOTON	Pesticides	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENDOSULFAN SULFATE	Pesticides	UG/KG	175	7720	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENDRIN ALDEHYDE	Pesticides	UG/KG	175	7720	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENDRIN KETONE	Pesticides	UG/KG	175	7720	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHANE, PENTACHLORO-	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHION	Pesticides	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHYL CYANIDE	Organics	UG/KG	176	7750	0	48.40	1,770.00	64,700.00	0.00	0.00	0.00	0.00	0.00
ETHYL METHACRYLATE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHYL METHANESULFONATE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLENETHIOUREA	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FAMPHUR	Pesticides	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FENSULFOTHION	Pesticides	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FENTHION	Pesticides	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FLUORENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEPTACHLOR	Pesticides	UG/KG	175	7720	0	0.02	0.62	22.60	0.00	0.00	0.00	0.00	0.00
HEXACHLOROBENZENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEXACHLOROBUTADIENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEXACHLOROCYCLOPENTADIENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEXACHLOROETHANE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEXACHLOROPROPENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 4. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to zero

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
INDENO(1,2,3-CD)PYRENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IODOMETHANE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISODRIN	Pesticides	UG/KG	175	7720	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPHORONE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOSAFROLE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LEPTOPHOS	Pesticides	UG/KG	176	7750	0	0.35	9.84	319.00	0.00	0.00	0.00	0.00	0.00
LINDANE (GAMMA-BHC)	Pesticides	UG/KG	175	7720	0	0.17	2.54	37.80	0.00	0.00	0.00	0.00	0.00
LONGIFOLENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MALACHITE GREEN	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MALATHION	Pesticides	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MESTRANOL	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHAPYRILENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHOXYCHLOR	Pesticides	UG/KG	175	7720	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHYL METHACRYLATE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHYL METHANESULFONATE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHYL PARATHION	Pesticides	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MEVINPHOS (PHOSDRN)	Pesticides	UG/KG	178	7750	0	0.13	4.08	148.00	0.00	0.00	0.00	0.00	0.00
MIREX	Pesticides	UG/KG	175	7720	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MONOCROTOPHOS	Pesticides	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N-NITROSODI-N-BUTYLAMINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 4. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to zero

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
N-NITROSODIETHYLAMINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N-NITROSODIMETHYLAMINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N-NITROSOMETHYLETHYLAMINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N-NITROSOMETHYLPHENYLAMINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N-NITROSOMORPHOLINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N-NITROSOPIPERIDINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N,N-DIMETHYLFORMAMIDE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NITROBENZENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
O-ANISIDINE	Organics	UG/KG	176	7750	0	6.72	100.00	1,550.00	0.00	0.00	0.00	0.00	0.00
O-TOLUIDINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
O-TOLUIDINE, 5-CHLORO-	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P-DIMETHYLAMINOAZOBENZENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P-NITROANILINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PARATHION	Pesticides	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PENTACHLOROBENZENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PENTACHLOROPHENOL	Organics	UG/KG	176	7750	0	204.00	3,300.00	53,400.00	0.00	0.00	0.00	0.00	0.00
PENTAMETHYLBENZENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERYLENE	Organics	UG/KG	176	7750	0	51.80	1,890.00	68,300.00	0.00	0.00	0.00	0.00	0.00
PHENACETIN	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PHENOL, 2-METHYL-4,8-DINITRO-	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 4. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to zero

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
PHENOTHIAZINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PHORATE	Pesticides	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PHOSMET	Pesticides	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PHOSPHAMIDON	Pesticides	UG/KG	176	7750	0	1.05	15.20	232.00	0.00	0.00	0.00	0.00	0.00
PHOSPHORIC ACID, TRIMETHYL ESTER	Pesticides	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PHOSPHORIC TRIAMIDE, HEXAMETHYL-	Pesticides	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PRONAMIDE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PYRIDINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RESORCINOL	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SAFROLE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SQUALENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERBUFOS	Pesticides	UG/KG	176	7750	0	39.50	630.00	16,700.00	0.00	0.00	0.00	0.00	0.00
1ETRACHLORVINPHOS	Pesticides	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TETRAETHYLDITHIOPYROPHOSPHATE	Pesticides	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
THANAPHTHENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
THIOACETAMIDE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
THOXANTHE-9-ONE	Organics	UG/KG	176	7750	0	14.70	536.00	19,600.00	0.00	0.00	0.00	0.00	0.00
TOLUENE, 2,4-DIAMINO-	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOXAPHENE	Pesticides	UG/KG	175	7720	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,3-DICHLOROPROPENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 4. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to zero

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
TRANS-1,4-DICHLORO-2-BUTENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRIBROMOMETHANE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRICHLOROFON	Pesticides	UG/KG	176	7750	0	2.13	69.60	2,530.00	0.00	0.00	0.00	0.00	0.00
TRIPHENYLENE	Organics	UG/KG	176	7750	0	11.50	422.00	15,400.00	0.00	0.00	0.00	0.00	0.00
TRIPROPYLENEGLYCOL METHYL ETHER	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VINYL ACETATE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VINYL CHLORIDE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-BROMO-2-CHLOROBENZENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-BROMO-3-CHLOROBENZENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-CHLORO-3-NITROBENZENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYLFLUORENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYLPHENANTHRENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-NAPHTHYLAMINE	Organics	UG/KG	176	7750	0	127.00	2,050.00	33,100.00	0.00	0.00	0.00	0.00	0.00
1-PHENYLNAPHTHALENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,1-DICHLOROETHANE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,1-DICHLOROETHENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,1,1-TRICHLOROETHANE	Organics	UG/KG	176	7750	0	87.60	1,410.00	22,900.00	0.00	0.00	0.00	0.00	0.00
1,1,1,2-TETRACHLOROETHANE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,1,2-TRICHLOROETHANE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,1,2,2-TETRACHLOROETHANE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



TABLE 4. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to zero

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
1,2-DIBROMO-3-CHLOROPROPANE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2-DIBROMOETHANE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2-DICHLOROBENZENE	Organics	UG/KG	176	7750	0	21.50	1,590.00	117,000.00	0.00	0.00	0.00	0.00	0.00
1,2-DICHLOROETHANE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2-DICHLOROPROPANE	Organics	UG/KG	176	7750	0	0.04	3.11	230.00	0.00	0.00	0.00	0.00	0.00
1,2-DIPHENYLHYDRAZINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,3-TRICHLOROBENZENE	Organics	UG/KG	176	7750	0	7.95	587.00	43,400.00	0.00	0.00	0.00	0.00	0.00
1,2,3-TRICHLOROPROPANE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,3-TRIMETHOXYBENZENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4-TRICHLOROBENZENE	Organics	UG/KG	176	7750	0	51.40	2,580.00	184,000.00	0.00	0.00	0.00	0.00	0.00
1,2,4,5-TETRACHLOROBENZENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3-BUTADIENE, 2-CHLORO	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3-DICHLORO-2-PROPANOL	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3-DICHLOROBENZENE	Organics	UG/KG	176	7750	0	8.82	416.00	30,600.00	0.00	0.00	0.00	0.00	0.00
1,3-DICHLOROPROPANE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3,5-TRITHIANE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,4-DINITROBENZENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,4-NAPHTHOQUINONE	Organics	UG/KG	176	7750	0	16.80	272.00	4,400.00	0.00	0.00	0.00	0.00	0.00
1,4-NAPHTHOQUINONE, 2,3-DICHLORO-	Pesticides	UG/KG	175	7720	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,5-NAPHTHALENE DIAMINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 4. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to zero

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
2-(METHYLTHIO)BENZOTHIAZOLE	Organics	UG/KG	176	7750	0	48.20	1,760.00	64,400.00	0.00	0.00	0.00	0.00	0.00
2-CHLOROETHYL VINYL ETHER	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-CHLOROPHENOL	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-ISOPROPYLNAPHTHALENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLBENZOTHIAZOLE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-NITROANILINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-NITROPHENOL	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-PHENYLNAPHTHALENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-PROPEN-1-OL	Organics	UG/KG	176	7750	0	0.12	1.95	31.20	0.00	0.00	0.00	0.00	0.00
2-PROPENAL	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-PROPENENITRILE, 2-METHYL-	Organics	UG/KG	176	7750	0	163.00	5,990.00	218,000.00	0.00	0.00	0.00	0.00	0.00
2,3-BENZOFLOURENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DICHLOROANILINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DICHLORONITROBENZENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3,4,6-TETRACHLOROPHENOL	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3,6-TRICHLOROPHENOL	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DICHLOROPHENOL	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLPHENOL	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DINITROPHENOL	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DINITROTOLUENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 4. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to zero

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
2,4,5-TRICHLOROPHENOL	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4,6-TRICHLOROPHENOL	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,6-DI-TERT-BUTYL-P-BENZOQUINONE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,6-DICHLORO-4-NITROANILINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,6-DICHLOROPHENOL	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,6-DINITROTOLUENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-CHLOROPROPENE	Organics	UG/KG	176	7750	0	9.44	152.00	2,470.00	0.00	0.00	0.00	0.00	0.00
3-METHYLCHOLANTHRENE	Organics	UG/KG	176	7750	0	1.49	21.90	367.00	0.00	0.00	0.00	0.00	0.00
3-NITROANILINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,3'-DICHLOROBENZIDINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,3'-DIMETHOXYBENZIDINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,8-DIMETHYLPHENANTHRENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-AMINOBIPHENYL	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-BROMOPHENYL PHENYL ETHER	Organics	UG/KG	176	7750	0	143.00	2,310.00	37,400.00	0.00	0.00	0.00	0.00	0.00
4-CHLORO-2-NITROANILINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-CHLORO-3-METHYLPHENOL	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-CHLOROPHENYLPHENYL ETHER	Organics	UG/KG	176	7750	0	104.00	3,730.00	136,000.00	0.00	0.00	0.00	0.00	0.00
4-NITROPHENOL	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4,4'-DDD	Pesticides	UG/KG	175	7720	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4,4'-METHYLENEBIS(2-CHLOROANILINE)	Organics	UG/KG	176	7750	0	0.07	5.30	391.00	0.00	0.00	0.00	0.00	0.00
						0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 4. NATIONAL POLLUTANT CONCENTRATION PERCENTILE ESTIMATES FROM THE NATIONAL SEWAGE SLUDGE SURVEY  
Candidate Pollutants for Round Two Regulations

Nonparametric Substitution Method Estimation Procedure - Nondetects Set to zero

Pollutant	Type	Unit	Sample Size	POTWs	Percent Detect	Mean	Standard Deviation	Observed Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	50th Percentile
4,5-METHYLENE PHENANTHRENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5-NITRO-O-TOLUIDINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7,12-DIMETHYLBENZ(A)ANTHRACENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ACENAPHTHENE	Organics	UG/KG	176	7750	0	1.27	46.60	1,700.00	0.00	0.00	0.00	0.00	0.00
ACENAPHTHYLENE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ACRYLONITRILE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ANILINE	Organics	UG/KG	176	7750	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dioxins a	Dioxins	NG/KG	174	7714	0	54.10	168.00	1,700.00	547.00	518.00	250.00	84.90	11.20
PCB a	Pesticides	UG/KG	175	7720	0	393.00	1,790.00	13,400.00	8,700.00	2,470.00	1,320.00	663.00	0.00
PCB-1016	Pesticides	UG/KG	175	7720	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PCB-1221	Pesticides	UG/KG	175	7720	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PCB-1232	Pesticides	UG/KG	175	7720	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PCB-1242	Pesticides	UG/KG	175	7720	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

(a) Composites considered a detect if all individual congeners or PCBs are measured above the minimum level.

TABLE 5

## SEMIQUANTITATIVE METALS in the NATIONAL SEWAGE SLUDGE SURVEY

CAS NUMBER	CHEMICAL NAME	CAS NUMBER	CHEMICAL NAME
7440699	BISMUTH	7440246	STRONTIUM
7440451	CERIUM	7704349	SULFUR
7429916	DYSPROSIUM	7440257	TANTALUM
7440520	ERBIUM	13494809	TELLURIUM
7440531	EUROPIUM	7440279	TERBIUM
7440542	GADOLINIUM	7440291	THORIUM
7440553	GALLIUM	7440304	THULIUM
7440564	GERMANIUM	7440337	TUNGSTEN
7440575	GOLD	7440611	URANIUM
7440064	PLATINUM	7440031	NIOBIUM
7440097	POTASSIUM	7440644	YTTERBIUM
7440100	PRASEODYMIUM	7440042	OSMIUM
7440155	RHENIUM	7440677	ZIRCONIUM
7440166	RHODIUM	7440053	PALLADIUM
7440188	RUTHENIUM	7723140	PHOSPHORUS
7440199	SAMARIUM	7553562	IODINE
7440202	SCANDIUM	7439885	IRIDIUM
7440213	SILICON	7439910	LANTHANUM
7440586	HAFNIUM	7439932	LITHIUM
7440600	HOLMIUM	7439943	LUTETIUM
7440746	INDIUM	7440008	NEODYMIUM